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Another Note from Professor Crocker.

TO THE EDITOR OF ELECTRICAL REVIEW:

I beg leave to slightly modify a statement contained in the ELECTRICAL REVIEW of May 10, concerning my article on "Alternate Current Flow," in the same issue.

The statement to which I refer is to the effect that *I do not agree with Sir William Thomson* on certain points. This sounds audacious enough on my part to make an excellent *joke*, but it really does not fairly represent my position.

The subject of my article is one about which Sir William Thomson certainly made a mistake in the *Philosophical Magazine* for March, but he corrects himself immediately in a postscript to the article. This postscript is, however, very short and confusing, and fails to state the true facts, or the reasons for them, so I venture to do so. Doubtless Sir William Thomson understands the matter perfectly, but did not have time to explain it. FRANCIS B. CROCKER.

School of Mines, Columbia College,
New York, May 10, 1890.

Advantages of Telegraphy.

The reporter who has been an operator has a decided advantage in getting his copy to the office by telegraph. A year or two ago, one who had a knowledge of telegraphy was sent to Dobbs Ferry late at night on an extremely important affair. He arrived there at 11 o'clock, had to drive a considerable distance from the station, and it was 1 A.M. when he returned to the depot. The last train had gone, and the telegraph office closed a long time before. A watchman or trackwalker at the depot said that the operator lived a mile and a half away, that he was ill anyhow, and that there was no possibility of sending anything by wire that night.

When the watchman had obligingly taken a walk up the track, the writer tried the office window, found the catch rather loose, and, with the thin blade of a pocket knife, soon removed the fastening. To open the window, crawl in and connect the wires in the switchboard, was the work of a moment. "N. Y." was called and raised, and the loop to the newspaper office asked for. Twelve hundred words were sent in before 2 o'clock, without copy, it being necessary, for lack of time, to compose the story as it was telegraphed on the key. This was done in the dark for fear the watchman would see a light and come back and shoot the reporter for burglary. "O.K." having been received, the reporter went outside, closed the window, and spent the remainder of the night gazing at the moon and throwing pebbles in the Hudson.

Embarrassed by the Electric Light.

A reporter of the Burlington, Iowa, *Hawkeye*, describes an interesting event that recently occurred in that city, as follows:

The other evening the writer, strolling leisurely homeward, had almost overtaken a young couple, still more leisurely strolling along, very much engrossed in each other's society, when suddenly the electric light gave out. For a minute or two the whole procession stopped, utterly blinded by the sudden change, when, presto! the light flashed out again, and disclosed the aforesaid couple tightly wrapped in each other's arms, a stately head bent low over an upturned face, and a wealth of raven tresses scattered promiscuously over a proud, masculine shoulder. May be there wasn't a hasty scramble for correct positions. Your informant ventured the remark, "pleasant evening!" (you know it appeared rather pleasant) but could get no reply. Is this irregularity of lighting a necessity, or are they simply playing a joke on us?

Swindled by a Telephone Message.

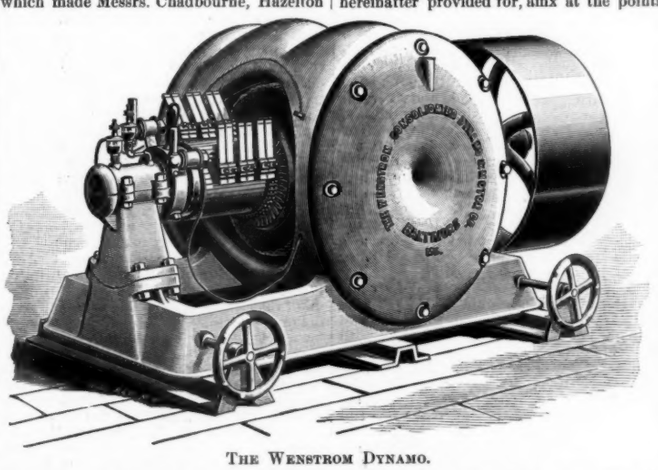
James Thompson, of Brooklyn, got the contract last week to supply the county buildings at Flatbush with coffee for three months at 17.94 cents per pound. The only other bidder was Francis H. Leggatt, at 17.59 cents per pound, but as Mr. Leggatt had not observed the rule to enclose a certified check with his bid as a guarantee of good faith, the contract was awarded to Thompson. President Gott, of the Board of Charities, asked Leggatt's representative why he had not sent the check.

"We were told over the telephone that it would be useless to put in a check as we would not get the contract," was the reply.

He could not tell who had been at the telephone in the commissioners' office.

The Wenstrom Dynamo.

In this journal, last week, we made mention of the new organization of the Wenstrom Consolidated Dynamo and Motor Company, at Baltimore, Md., and the business arrangement which had been entered into, which made Messrs. Chadbourne, Hazelton & Company, of Philadelphia, the sole selling agents for this improved dynamo and motor.



THE WENSTROM DYNAMO.

We are pleased to be able to present to our readers, on this page, an excellent illustration of this dynamo, a machine that is attracting attention in electric lighting and power circles. It is very compact and efficient, the one represented on this page being an 800 lighter.

It is the invention of Jonas Wenstrom, a Swede, and all the rights, for both lighting and power purposes, in the United States, are owned by the Baltimore company.

A number of tests, recently made by the Electric Testing Bureau of the Johns Hopkins University, gave the dynamo a standing in the electrical field which ranks it among the best.

The company is strong financially, and enters the field for the sole purpose of manufacturing, and that on a large scale.

Telegraph Conference at Berlin.

In the Telegraph Conference, Germany proposes two uniform rates of 12½ and 15 centimes per word between all European countries. Each country is to retain the telegraph revenue as in the case of the postal revenue, only paying 60 centimes per message to each country through which a message passes.

From Massachusetts.

Senator Metcalf, on May 5th, reported from the Committee on Mercantile Affairs a bill to regulate the control and supervision of electric wires.

SECTION 1. Every person or corporation, private or municipal, owning or operating a line of wires over streets or buildings in a city, shall use only wires that are suitable and strong, shall suitably and safely attach them to strong and sufficient supports and insulate them at all points of attachments, and shall remove all wires abandoned for use, shall suitably insulate every wire where it enters a building, and if such wire is other than a wire designated to carry an electric light current, shall attach to it at a suitable and convenient point near the place of entering the building, an appliance calculated to prevent at all times a current of electricity of such intensity or volume as to be capable of causing fire from entering the building by means of such wire beyond the point at which such appliance is attached, and shall suitably insulate every wire within a building when such wire is designed to carry an electric light current.

SEC. 2. Every such person and corporation shall, in the several cities, within six months after the appointment of the officer hereinafter provided for, affix at the points of support at which any such wire or cable containing wires is attached, a tag or mark distinctly designating the owner or user of such wire or cable. No such tag or mark shall be required for the wires of a street railway company used for the transmission of its motive power, or for the protection or support of such wires.

The bill also provides for the appointment of an inspector in each city to see that the law is enforced.

Book Notices.

We have received the April number of the *Western Engineer*, published by the Pond Engineering Company. This journal is meeting with considerable success in the field to which it caters.

Messrs. Pitt & Scott's book of information for intending travelers to Europe has been received. Any of the electrical fraternity intending to make a trip abroad this summer, will do well to apply for the book, which is sent free of charge. It contains much valuable information.

The odor of paint is abroad in the land. The Summer car is out, likewise the straw hat. Your lease has expired, and you have been moved to change your abode. "There's many a man can change his mind who cannot change his residence." All this signifies Spring has come.

Properties of Aluminum.

The specific gravity of aluminum being taken as one, soft steel is very nearly 2.95 times as heavy; copper, 3.6 times as heavy; ordinary high brass, 3.45 times as heavy; nickel, 3.5 times as heavy; silver, 4 times as heavy; lead, 4.8 times as heavy; gold, 7.7 times as heavy.

A sheet of aluminum 12 inches square and one inch thick weighs 14.03 pounds; a bar of aluminum one inch square and 12 inches long will weigh 1.17 pounds; a bar of aluminum one inch in diameter and 12 inches long will weigh 0.918 pounds.

A cubic inch of cast aluminum weighs....	0.092	lb
A cubic foot of cast aluminum weighs....	158.967	"
" " soft steel weighs.....	490.450	"
" " wrought iron weighs.....	485.874	"
" " copper weighs.....	554.988	"
" " ordinary brass weighs....	524.160	"

Aluminum has about the tensile strength of cast iron, with only about one-third of its weight, and casts equally as easily and successfully, and will, therefore, be very advantageously used to replace cast iron in the parts of moving machinery that have to be reversed or otherwise have their momentum overcome; for with one-third the weight, and consequently one-third the momentum, aluminum will work very satisfactorily.

Pure aluminum melts and becomes fluid at about 1,200 degrees Fahrenheit. The amount of impurity in aluminum materially alters its melting point. One per cent. of iron raises the melting point over 100 degrees. It does not remain firm like lead almost to the fluid point and then suddenly give away, but has a stage of from 1,000 to 1,200 degrees Fahrenheit, in which the metal becomes pasty, looses much of its power of cohesion, and during which stage, if the metal be gently pressed together, it can be readily welded. It is, however, very red-short at this temperature, and will not stand hammering to weld the metal without crumbling down. If the metal is not too long a time in this pasty condition it does not seem to become injured after being again cooled down.

Employers' Liability Assurance Company.

This company, London, England, insures employés of electric light stations and electrical manufacturing companies at a very reasonable rate, thus relieving the company from liability for injuries to the employé incurred through negligence of the manager or foreman.

The policy covers any and every person who may be employed by the insured. Names of workmen are not required; the employer may change his workmen, or their number, or their wages, as often as he pleases without notice to the corporation; the policy continues in force for 12 months, or until the amount of wages mentioned therein is exhausted. If the whole of such wages is not paid within the policy year, a proper proportion of the premium is credited towards the next policy. The corporation pays the cost of rendering immediate medical aid to any injured employé.

This company conducts the defense of suits without expense to the policy holders, and pays damages awarded. Valid and reasonable claims are also adjusted by and at the expense of the corporation. Already in the United States, employers of labor with pay rolls of about $70,000,000 have availed themselves of the protection offered by this policy.

The principal branch office of the company, in this country, is at No. 71 Kilby street, Boston, and Messrs. Endicott & Macomber are the managers and attorneys.

Single and Double Trolley Wire Systems for Electric Railways.

At a recent meeting of the Boston Electric Club, Mr. G. W. Mansfield, engineer of the railway department of the Thomson-Houston Electric Company, read a paper under the above title. The following is an abstract:

"In addressing you this evening on the subject of 'Single and Double Trolley Wire Systems for Electric Railways,' I shall endeavor to precisely place before you the advantages and disadvantages of each system. The other day, while studying over the subject, the following questions arose in my mind: Why should I spend any time whatever in discussing the two systems? Is it necessary? If so, why? I think my telephone friends here could answer that question, perhaps.

"My own thinking and experience has forced me to the solid conviction that for an efficient electric railway system, which can be universally used, the single trolley wire is the only one to be considered. Being then of this conviction, the time I spend upon the double trolley wire system is purely educational for my dear friends in the telephone companies, and I trust I merit their hearty applause since they all tell me they want electric railways and the best.

"The principles involved in the construction of a single trolley wire system are familiar to you all. You know that it can be done successfully and is done successfully. Do you or does any one know that under all the conditions under which the single trolley wire works successfully the double trolley system will also work successfully?

"If the difficulties with the single system have all been overcome and those of the double system have not, let us consider what we must take into account to make the latter equal the former.

"With the double system the weight of the second wire, the insulators, frogs, crossovers, etc., the double liability of sleet and ice accumulating on the two wires, and the high winds, all necessitate larger and stronger poles and stronger span, pull-off and anchor wires, etc. This increase in size and number of wires means additional unsightliness, a larger original outlay and an increased expense for maintenance.

"One of the chief troubles which an electric railway has to contend with is to keep its trolley wire free from snow and ice during the winter months. Prompt and energetic action, with a greased trolley wire, has saved the single trolley roads from any serious delays. If these same roads had had two wires to clean, I have no question but that their service would have been seriously impaired, if not entirely stopped.

"I do not think that the question of traction is one of any serious moment. The rails must be cleaned for adhesion and for the cars to keep on the track, irrespective of whether the single or double trolley wire system is used, and as they are get-at-able they are comparatively easily taken care of. It is simply a question of management, muscle and salt, and with improved electric sweepers and plows, there never need be any great difficulty in keeping the cars running on schedule time. The problem, however, of cleaning sleet frozen to a trolley wire placed 18 feet above ground in a large city, or even on a country road, is a most annoying and troublesome one.

"One, if not the greatest, difficulty which would have to be overcome with the double trolley system, is the liability to leakage. The two wires hanging side by side upon the same span wire need the best of insulators. Considering all the atmospheric conditions and the possible accumulations of sleet and snow, it unquestionably would be more difficult to maintain good insulation between the two wires than it is between the single wires and the ground. With the latter system you have far greater opportunities to introduce additional insulation. It can be cut into the span wire or placed on the pole, whether it be of iron or wood.

"So far the under-running double wire roads have had the wires placed either six inches or eighteen inches apart. The Daft roads employ the former distance, while the Thomson-Houston Company, in its attempt at Cincinnati, used the latter distance. Both methods have their objections. If the wires are placed too near, strong winds may swing them together, causing short circuits. In one place the short circuit was so heavy that the wires were melted and fell into the street. With the wires farther apart, plainly this trouble would not exist. With the wires close together a single trolley arm can be used, but a double trolley fork and two wheels are necessary. These wheels must be thoroughly insulated, whether they rotate upon a separate or upon the same spindle. The maintenance of an insulation sufficient to withstand 500 volts under such conditions is surely not an easy task.

"With the wires further apart the necessity of more than one frog at the crossings and turn-outs is necessary, which is objectionable, and more than one trolley arm would have to be used. The maintenance of these trolley arms, the difficulty of keeping them on the wires, and their weight upon the roof of the cars, are all serious objections. In the single wire system questions of weight, insulation of trolley wheels, etc., practically do not enter.

"Another serious objection to the double system is in the overhead switching. The placing of overhead frogs, even on the single wire system, requires the greatest exactitude and care, so much so that on many roads it has been found necessary to train a special gang of men to place and look after their adjustment. The expansion and contraction of the wires and the giving and taking of the poles, are constant sources of annoyance and trouble in keeping the frogs and insulators in place. The expansion of copper is $\frac{1}{6}$ inch per degree for 1,000 feet, or $\frac{5}{8}$ of an inch per mile for each degree of change in temperature. If the temperature changes, as it often does, 20 or 30 degrees in a day, the trolley wire might expand or contract 15 or 20 inches per mile. With the double trolley wire system the location and maintenance of the frogs on the cross-overs and turn-outs would, in view of these circumstances, be an extremely difficult one. They would require constant adjustment and re-adjustment, and if the method of placing the trolley wires 18 inches or more apart was employed, so that a large number of frogs was introduced, it would practically be a determining factor between the possible and the impossible system.

"On complicated systems of double track lines, the number of insulators and frogs for the double wire system would be very large. I have frequently studied such systems and have found that it is by no means a rare occurrence to meet arrangements of tracks that require from 25 to 50 overhead frogs and insulators, and, in some instances, from 125 to 150. The weight of all these necessarily demands a most substantial overhead construction, and, undoubtedly, the only thing that could be done would be to erect large and substantial trusses. It must be, also, evident that the difficulty of keeping the trolley wheel upon these wires is largely increased, and also the liability of some of the ends breaking loose from a frog and falling.

"On large roads the cost of copper necessary for the double wire system would be so great as to be almost prohibitory. With the single trolley system, the earth being used as a return circuit, we obtain the aid of its conductivity and also that of the rails. Practice has demonstrated that, with such an enormous conductive era, the resistance of the return circuit can practically be rendered *nil*. It is true that the supplementary wire, of a size equal to the trolley wire, is run through the earth and connected to each rail. The use of this conductor is two-fold. It not only forms a good ground for each rail, but it ties the whole underground system into one connected and complete metallic system. Counting the resistance of the earth as O, it is readily seen that only one-quarter of the copper wire is necessary for the single system as for the double wire system. Hence, a most decided saving is possible.

"On a large system the subject of feeders always is a most important one. With the single trolley system it is only necessary to feed one-half of the circuit, whereas, with the double trolley system it is necessary to feed both sides of the circuit. In this direction alone, therefore, the cost of the latter system must be four times that of the former, allowing for the same percentage of loss.

"In regard to guard wires, I see no reason why it is not practically as necessary to place them over a double wire system as over a single. With the current passing out over one wire down through the car, through the motors under the car and back by the other wire, the chances of leakage are very great.

"I do not deny the fact that it is possible to so construct a simple double trolley system that a falling wire touching one of the trolley wires and with its other end on the ground, would deflect no current, nor would I deny that under similar conditions a man touching this fallen wire and standing upon the ground would receive no shock.

"Repeating, therefore, what I have said in regard to danger to life and property, I feel that the danger question is practically equal in both systems.

"As to the relative expense of the two systems, leaving out the question of feeder wires, it is true that practically in every case the double trolley system would cost one-half as much more, if not twice as much, as the single trolley system. It may be here stated that the expense of running the supplementary wire underground is sometimes heavy. True, it is, but the expense is largely dependent upon the street through which your track passes. If it is macadamized or paved with Belgium blocks, or with any paving stones, the expense of the removal and replacement of the same would be large. Such conditions of streets, however, exist only in large cities, and here I believe it is generally conceded by friends and opponents that the double trolley system is entirely out of the question. The expense, however, would no where nearly equal the additional expense of the feeder wires for the double system, nor would it equal the cost of the maintenance of such a system for a year or two.

"If, on the other hand, I admit that it is possible, but not the best system for a small road, we are happily confronted by the fact that so far, in the majority of the cases, the small roads are not where it is needed, since the telephone companies, which practically represent the only opposition to the introduction of the electric railway, have not so extensive lines in these places. It is, therefore, the unfortunate middle man that has to suffer. In answer to all the foregoing objections to the double trolley wire system, the statement is sometimes made that there are to-day double trolley roads operating commercially successful; and if they can operate in one place there is no reason why they cannot be made to operate in all other places. Steam dummies are used to-day in some places; why do not railroad companies use them everywhere? There is scarcely anything impossible in this practical age of ours, and, therefore, I do not deny that the double trolley system could not be placed anywhere that the single is placed, but I unhesitatingly state and know that it could not be placed wherever the single is placed, and prove equally as satisfactory and commercially successful. It is not a question of cost, but one of expediency and practicability. The electric companies would build double systems if they could guarantee them, and the railroad companies would demand them if they had confidence in them. An unbiased thinking man is forced to adopt the single system.

"History shows that the efforts of the early promoters of the electric railway were to develop a double wire system with an over-running trolley. This has proved a signal failure. The only roads so operated to-day are at Easton, Pa., Elkhart, Ind., Ithaca, N. Y., Lima, Ohio, Pittsburgh, Pa., Sunbury, Pa., St. Catharines, Ont., Lancaster, Pa., Asbury Park, N. J., Appleton, Wis., and Wheeling, W. Va.; 11 in all. There are none under contract, and no firm thinks for a moment of building such a system. History also shows us that the next step in progression was the development of the under-running trolley for this same double trolley wire system. Years have gone by, and we have only three companies in the whole United States having such a system in operation; these are at Cincinnati, O., Meriden, Ct., and Mansfield, O. As illustrative of the feeling and confidence the street railway profession have in this system, I find there are but five companies who have contracted for such a system. I venture to assert at this point that if the conditions of the contracts for these roads were seen, most interesting and extraordinary clauses would be discovered.

"If we now turn to the extraordinary development of the single trolley system, we find figures which truly are amazing. On July 1st, 1888, the Thomson-Houston Company was not in the electric railway business, and the total number of roads in operation in the United States and Canada, put in by all of the electric companies, who then were doing business, viz: Sprague, Daft and Van Depoele, was 33. Of these but two or three were the single wire system under-running trolley; whereas, to-day, there are nearly 115 roads in operation, and an equal number under contract, and of these all but some four or five have been put in or contracted for by either the Thomson-Houston Company or the Sprague Company. Two hundred and thirty roads contract for the single system, five for the double. If I take the history of the Thomson-Houston Company since it commenced to build electric railways, I will find that it has in less than two years, put 61 roads in operation, and has under contract 45 more, making a grand total of 106 roads contracted for with the single trolley system, by one company. Could there be more conclusive proof of the pre-eminent adaptability to a commercial necessity than this is, for the single trolley system?

"The future is destined to surpass this record as surely and as amazingly as the adoption of electric lights and telephones surpassed their records of eight or ten years ago."

After the reading of the paper, a brief discussion upon the points raised took place, Mr. W. J. Denver, Mr. Dumoulin, Mr. F. M. Gilley and Mr. Alex. P. Wright, taking part.

Took Five Hundred Volts.

George Morse, a press boy of the Lynn *Bee*, attempted, one day last week, to test the strength of the current applied to the electric motor which supplies the power to the office machinery. He completed a perfect circuit and received the full force of 500 volts. He remained insensible 20 minutes, and was then taken to his home. The doctors say that he will be all right in a few days.

Hauberg's Dynamo and Method of Compounding.

Amongst the numerous improvements in the construction and making of dynamo machines, says the London *Electrical Review*, the application of cast iron in the field magnets is certainly of importance. It has made it easy to build even very powerful dynamos cheaply by casting in one piece the field magnets and frame, and thus avoiding any division or interruption in the metallic part of the magnetic circuit. The weight of copper on the field magnets is also reduced, although one would think that the larger section of cast iron would increase the length of the windings. However, the more perfect proportions in the well-constructed dynamos of the latest date explain this.

The figures show a dynamo constructed by Mr. S. C. Hauberg (Messrs. Koefoed & Hauberg, Limited, Copenhagen). It is entirely made of cast iron of selected brands, and is as plain and compact as possible. The field magnet is of the horse shoe shape, cast in one piece with the frame; the wire for exciting the magnet is wound on the vertical part of the magnet. This shape gives the shortest way for the lines of force, and there is no interruption in the magnetic circuit except the space between the pole shoes and the armature; this allows a very solid construction and an extremely accurate run of the armature without vibration, and with but little distance from iron to iron in the magnetic field. It also enables the winding of the wire to be done on a common turning lathe.

To show how small the weight of copper is on this type of dynamo, we give the following example from a private electric installation in Copenhagen, which required two dynamos, each able to supply the current for 1,000 lamps of 16 candle-power. The dynamos are working with 100 volts at the lamps, and give a current of 500 amperes when running at 500 revolutions per minute. The armature has a diameter of 23½ inches, and is 29½ inches long; it is wound as a Gramme ring with 88 copper bars, divided in a suitable manner to avoid any heating through Foucault currents; the copper bars are connected with a commutator divided into 88 parts. The field magnet has a section of 12x29½ inches, and is wound according to a new system to obtain self-regulation, which is described further down. The weights of copper are: On the armature, 194 lbs.; on the field magnet, 346 lbs. As the dynamo, when working at 500 amperes, has a difference of potential of 115 volts at the brushes, we get 57.7 volt-amperes per pound of copper on the armature at 100 revolutions, and 20.75 volt-amperes per pound of total weight of copper on the dynamo at 100 revolutions. The electric efficiency is 96 per cent.; the cooling surface of the machine is very great, and the heating is, therefore, insignificant.

The above mentioned new system of self-regulation is invented by Mr. F. V. Schioedet, electrical engineer to Messrs. Koefoed and Hauberg, and consists of the following arrangement in the winding of the magnet: The purpose of the system is to make it possible to work two or more compound wound dynamos in parallel circuit without any danger of the one dynamo reversing the magnetism of the other; this is a point of the greatest importance. The new system may be used wherever by one system or another a larger loss of potential is allowed in the main conductors than is allowable between the different lamps or points wherefrom wires are leading to the lamps. If, for instance, the dynamo is placed, by some reason or other, at a distance from the rooms to be lighted, we may, to save the expense of a very heavy cable, which would give no loss of potential, use a smaller cable and have a higher potential at the dynamos, and then take these compound wound according to this system. If we have water power, and the dynamos, therefore, are placed far away from the lamps, it would be of the greatest importance to have them compound wound and self-regulating, and yet involving no danger if two or more are working together. We may also apply this new

system in such installations, when the main conductors are laid, as invented by Gülcher, in the manner that they form a positive and a negative bend or interrupted ring, both with the one end in connection with a brush of the dynamo and the wires leading to the lamps leaving the said bends at suitable points of the conductors, so that the loss of potential in the positive conductor to such a point of it added to the loss of potential in the negative conductor to the corresponding point is the same for every two points wherefrom wires are leading to the lamps. In the diagram M + and M− are the two main conductors connected with the brushes of the two dynamos of the said installation. With 500 amperes the loss of potential in the conductors is 15 volts. Now, if we use compound dynamos, working in parallel circuit, we shall not get the same potential at the brushes if we work one dynamo with 500 amperes, as if we run two with 250 amperes each, as the increase of potential is dependent upon the current passing the main wire on the field magnet. If we shift the current from the one dynamo to the other we should also get a lower potential until the whole current was supplied from one dynamo only. This is avoided thus: In a common compound dynamo we have on the field magnet a shunt wire connecting the two brushes, always being passed by nearly the same current, and then we have the main current passing round the magnet in a thick wire; in Mr. Schioedet's system we have the shunt wire in the same way, but instead of the main current he applies a shunt on the main conductor, connecting two points either on the positive or the negative conductor; this main shunt is passed by a current, dependent upon the loss of potential between the points. By this way the increase of potential is only dependent upon the total current in the main conductor, the current in the main shunt being increased by the greater current in the main conductor, causing a larger loss of potential; little and large dynamos can be coupled together, their potential being increased simultaneously in proportion to the loss of potential between the two ends of the said main shunt. The diagram will explain it sufficiently. M + and M − are the main conductors, in which we are working with a certain loss of potential. B + and B − are, respectively, the positive and negative brushes, with which the shunt windings, S, are in connection. The two positive brushes, B +, are, by the main shunt T, connected with the point, P, at the farthest away end of the positive main conductor, M +. By a correct calculation of the loss of potential from the brush B +, and the point P, and putting a suitable number of windings of the main shunt, T, on the field magnet, this current will just increase the potential at the brushes as the loss of potential requires. It will be quite clear, from the diagram, that the one dynamo cannot reverse the magnetic poles of the other, as the main shunt and the ordinary shunt both are passed in the same by the current, even if the one dynamo sends its current through the armature of the other.

Fort Wayne's Prosperous Electrical Industries.

The Fort Wayne Electric Company has declared a semi-annual dividend of three per cent. from the earnings of its first six months' business, payable May 15, to stockholders of record May 10. The annual report shows sales for the six months ending March 1, 1890, of $760,339.31. After deducting from the accounts receivable 25 per cent. and taking stocks held in local companies at 33⅓ per cent. of their par, a net profit is shown of $173,334.03, which leaves a surplus of $82,334 above the dividend of three per cent. Under this management business has trebled, and the cost of manufacture has been largely reduced. Orders for electrical supplies have accumulated so rapidly that the company will be obliged to very largely increase its manufacturing facilities. At present there are sufficient orders on hand to keep the works running at their full capacity until the winter months.

Electricity as a Safe Illuminant.

It would be impossible to conceive of better testimony to the pre-eminence of electricity as a safe illuminant than is furnished by the experience of the Boston Manufacturers' Mutual Insurance Company, says the *Roller Mill*. A circular recently issued by Edward Atkinson, president, states that since April, 1882, a period of eight years, the company has received no notice of any fire in any of its risks that could be attributed to electricity. Previous to 1882, the company received notice of 23 fires of electrical origin among the 61 mills which had then been lighted by electricity, and investigation disclosed conditions directly due to poor material, want of proper insulation, and faulty installation. With the framing and enforcing of strict rules for the construction and putting up of electrical apparatus, these fires ceased. Electricity is now used for illuminating or as a motive power in over 600 risks which are carried by the factory mutual companies.

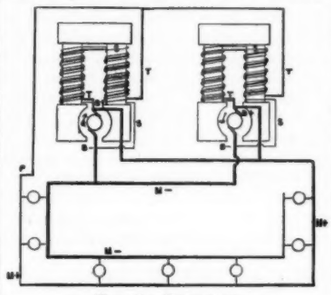


FIG. 3.—DIAGRAM.

It is clearly shown by these facts, first, that electricity improperly applied may be quite as dangerous as any other agency for furnishing light or power; and, second, that electricity properly applied is so safe and controllable as to be an ideal servant of man. We, therefore, urge upon millers, continues our contemporary, the necessity of exercising great care, not only in the selection, but also in the installation of their electrical equipments. The rapid extension of electric lighting has drawn into the field many self-styled electrical engineers, who, by cheap apparatus and slip-shod work, are able to put in plants at lower cost than would be possible for any reputable electricians. These cheap engineers will ultimately prove dear at any price, for their work will be imperfect, short-lived and unsafe. Having decided upon lighting his mill by electricity, the miller should contract with some house or party of known experience and unquestionable integrity. Such a course will cost more at the outset, but in the long run it will be found to be the most economical.

The introduction of the Westinghouse alternating current arc light system is growing in favor rapidly. The company is constantly in receipt of complimentary letters which testify to the many advantages of the system. The demand for the alternate current arc light apparatus is increasing at a wonderful rate, and the productive capacity of the Pittsburgh works is tested to its very utmost. Of late, many inquiries have been made for a smaller dynamo than the ordinary 60-light machine. To meet this demand, the company is now manufacturing a small 25-light dynamo of a unique design.

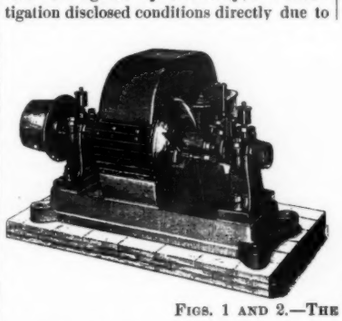
The Plant of the Municipal Company, St. Louis.

On May 1st, the Municipal Electric Light and Power Company began lighting the city of St. Louis, with 1,613 arc lights on a 10 years' contract at $74.95 per light, per annum. The lamps are to begin burning 45 minutes after sunset and to be cut out 30 minutes before sunrise, and are to burn every night in the year. The city has the option of purchasing the plant at the end of the contract, which will be May 1, 1900.

This is said to be the largest arc light plant in the world, costing about $700,000. The company have six 600 horse-power Corliss engines, with foundations laid for six more of same size, twenty 300 horse-power boilers, manufactured by Rohan Bros., St. Louis. They have put up 492 miles of No. 5 Simplex line wire, 4,500 white cedar, 2,000 Norway pine and 500 cypress poles erected, furnished by C. H. Holmes & Company, of St. Louis.

They start up with 39 sixty-light "Wood" dynamos, manufactured by Fort Wayne Electric Company. The longest circuit is 18 miles with 57 lights. Besides the 1,613 city lights, the company have 50 lights in and around the station and 300 commercial lights.

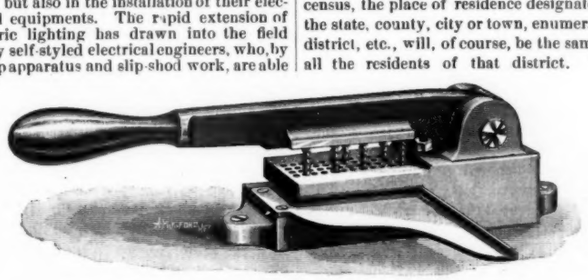
There is an ordinance now before the municipal assembly, providing for the addition of 500 more arc lights for city use which with the other lights will make 2,463 arc lights from this one station.



FIGS. 1 AND 2.—THE HAUBERG DYNAMO.

Electric Tabulating.

In the Hollerith Electric Tabulating System, as heretofore explained in this journal, punched record cards are used to represent the individuals to be tabulated, the different punch marks representing the characteristics of the individual. In preparing such punched record cards, it will often happen that for a large number of the individuals a portion of the record will be the same, so that this portion of the record is to be transcribed by punching the same combination for a corresponding number of cards. For example, in the case of a census, the place of residence designated by the state, county, city or town, enumerator's district, etc., will, of course, be the same for all the residents of that district. This happens to such an extent that valuable use can be made of the "gang punch" designed for this purpose and illustrated herewith.



PUNCH USED IN HOLLERITH ELECTRIC TABULATING SYSTEM.

This gang punch consists essentially of a die-plate provided with holes corresponding to the possible holes in the punched card. Over this is a guide plate with corresponding number of holes in any of which plungers or punches can be inserted according to the combination it is desired to punch. Above this is a suitable lever for the purpose of operating these punches. A card holder or guide is attached so that a number of cards can be inserted between the die and punch plate against suitable stops, so that when the lever is depressed holes will be punched through these cards corresponding to the combination designating the given district, city or town, county, state, etc.

To adjust the punch for any other combination it is simply necessary to throw back the lever and change the position of one or more punches according to the new combination. The punch can, of course, be readily arranged to operate by means of a pedal or other suitable source of power.

Tacoma, Wash.—The Tacoma Electric Company; capital stock, $25,000; trustees, L. G. Biglow, A. C. Balch.

Johnson City, Tenn.—The Wautauga Lighting and Power Company has filed its charter in the Secretary of State's office.

La Crosse, Wis.—The La Crosse Brush Electric Light and Power Company; amended articles increasing the capital to $100,000.

Milwaukee, Wis.—The Cream City Railway Company, capital $100,000; incorporators, Oren E. Britt, Chas. C. MacConnell and F. C. Winkler.

Tillamook, Ore.—Tillamook and Astoria Telegraph and Telephone Company. Capital stock, $2,500. George Cohn, B. C. Lamb and A. P. Wilson, incorporators.

Chicago, Ill.—The Chicago Illuminating Company; to furnish electric light and power. Capital stock, $500,000. Incorporators, F. S. Wheaton, D. S. Gooding and E. M. Miles.

Kansas City, Mo.—The Consolidated Electric Light and Power Company. Capital stock, $200,000. Directors: I. D. Wilson, Benjamin Schierle, Benjamin Friedburg, Marcus Harris and C. F. Hutchings, all of Kansas City.

Toronto, Canada.—The Canadian Interior Conduit Company is being organized in Toronto, with a capital stock of $150,000, for the manufacture of conduits and tubes of compressed fibre or pulp for containing electric and other wires.

Santa Cruz, Cal.—Swanton & Clark Electric Light and Power Company, Santa Cruz. The capital stock is $50,000, divided into 5,000 shares of $10 each. Dr. H. H. Clark, J. F. Appleby, A. P. Swanton, F. W. Swanton and C. E. Lilly.

Walla Walla, Wash.—The Inland Telegraph and Telephone Company, replacing the Sunset-Hopkins system, has been organized at Walla Walla, Wash., with a capital of $300,000, paid up. W. S. Norman, of Spokane, is president; J. I. Sabin, of San Francisco, vice-president; Charles Sidney Smith, secretary; C. B. Hopkins, manager; C. P. Irvine, of Spokane, superintendent. The telephone system of Inland Empire reorganized lines will extend into Eastern Oregon. The headquarters are at Spokane.

Peterborough, Can.—The Peterborough, Canada, Gas and Electric Light Companies have merged into "The Peterborough Light and Power Company, Limited," for which incorporation is being sought. The new company will have a capital of $200,000, and has among its principal shareholders, Messrs. T. G. Hazlitt, Jas. Stevenson, M. P., Thos. Bradburn, Richard Hall, Geo. A. Cox, Wm. Walsh and Wm. Davidson. The new company intend putting in a new incandescent plant for lighting shops, offices, residences, etc. They will also introduce another new feature in the shape of electrical motors for the supply of power.

Rockville, Conn.—The council light committee at Rockville, Conn., will grant a public hearing in regard to granting the petition of the new Merchants' Electric Light Company for the right to erect poles and place wires in and through the streets at an early day. The hearing will probably be a spirited affair, as it is understood that the Rockville Gas and Electric Company, which has a Thomson-Houston plant in operation, will strongly oppose the granting of the right. The local company has a charter from the State Legislature, and the Merchants' Company is chartered under laws of the State of Maine. George F. Tolcott is president of the new company, and it is proposed to put in a Westinghouse plant.

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Now is the time to dust off your electric motor fan, oil her up, and see that your plug and connecting wires are all right. It won't be many days before you'll bless the man who invented the electric fan.

The murderer Kemmler is the object of many *habeas corpus* proceedings, and no one knows who is the agent. The condemned man's real attorney has instituted one, which was partially disposed of by Judge Underwood, at Auburn, last week. In it the point was presented that the law was unconstitutional, because it did away with the functions, as executioner, of the sheriffs, and lodged them in the wardens of the prisons, the contention being that sheriffs were constitutional officers. Judge Underwood held that the new law did not disturb the fundamental law, and now the point goes on to the appellate courts.

About nine o'clock last Saturday evening, a long distance telephone transmitter was placed in Miss Lillian Russell's dressing room at the Casino theatre, in this city. During the intermission between the first and second acts of "The Grand Duchess," Miss Russell sang her stirring and martial solo, "*Le Sabre de mon Pere*," into the transmitter, which was connected with a long distance line to Washington, D. C. A party of Congressmen and newspaper correspondents at the Washington end of the line were delighted with the fair singer's rendition of the delightful music, and expressed their astonishment at the perfect manner in which the sounds were transmitted.

We published, last week, the rules governing the handling of electric currents, formulated by Dr. George H. Benjamin, of this city. They are concise, yet comprehensive, and the practical workman will find valuable aid in them. The whole field is completely covered and we congratulate the Doctor on his timely work.

It is scarcely to be wondered at that electric lighting does not make more rapid progress in England than has been the case hitherto. The corporation of Bolton, a thriving industrial town in Lancashire, recently issued 1,178 circulars in connection with the proposed introduction of the electric light. Only 449 replies were received; of these but 45 (including one very large and important firm) desire the electric light; 24 wish for it if the price is the same as gas; 56 are uncertain by reason of the cost; 30 are doubtful and 314 convey an obsolute negative. In face of such deadly conservatism as this, what can electricians do?

There is a probability that the electric lights in the buoys in New York Harbor will be extinguished shortly, and navigators of Gedney's Channel be left to sail in darkness, in order to satisfy the eccentricities of legislative and executive "red-tape." The Lighthouse Board has an appropriation for the general buoyage service; and it had a small appropriation for the specific purpose of maintaining electric lighted buoys. The latter has been exhausted, and the Commissioner of Customs, who is the authority in such cases, is of the opinion that the general appropriation cannot legally be used to maintain the electric buoys. Another case of a similar nature is that of the new arc light plant just completed in the Washington Navy Yard. The department has plenty of money to pay for the plant but none to pay for operating it, and, therefore, it must remain idle until Congress makes special provision for the service. And after all "red-tape" is not to blame. Government officers must execute the laws; Congress makes the laws; voters elect the Congressmen, and a large part of the voting is done by men in the electrical business. The last mentioned fact gives hope that the world is growing better, and that the evils complained of will be remedied.

MAYOR GRANT'S INSULATION.

At the last meeting of the Board of Electrical Control, the electrician to the Board submitted a report embodying the observations of the experts of various electric light companies on the deteriorating effect of steam heat on the underground cables in the subways down town. From the mere fact that the opinions quoted were not Mr. Wheeler's own, the august godfather—beg pardon, we mean president—of the board allowed his potential to rise beyond the restraining powers of his insulation, and the reading of the report was interrupted by a discharge of high tension abuse from his excited Honor.

No doubt all allowance must be made for a Mayor whose insulation has been subjected to very severe tests by a high pressure investigating committee, but to an unprejudiced observer it would seem that the experts to the companies who use the subways were in the best possible position to give trustworthy information as to the condition of the cables, which it is part of their duties to test and report on at frequent intervals.

The fact is that all the companies who use the subways are compelled to submit to a very serious deterioration of their property in the down town district. Broadway was the only street referred to at the meeting of the board, and the Mayor stated that the leaks in the steam heating company's pipes would be repaired as soon as Broadway was torn up. Leaving aside the delightful prospect opened up by the prospective tearing-up of Broadway, implied in this remark, we would point out to the Mayor, that of the various streets down town through which the subways run, Broadway is one of the least offenders as regards heated ducts. The evil is far more general than Mayor Grant seems to imagine, but his own insulation is so defective that probably he considers that of the underground cables is quite high enough in spite of the hot soil in which they are buried.

THE NEWSPAPERS AND THE TELEPHONE.

Some of the daily newspapers have recently commented, both reportorially and editorially, on the surprising exhibition of the capabilities of the telephone to which the public is now being treated at the Lenox Lyceum. According to the learned authorities who manufacture the daily portions of mental food served out to newspaper readers, the most amazing feature of the whole exhibit is the fact of it being there at all. "Why," they ask "do the telephone companies have the audacity to demonstrate to the public the perfection of the art of telephony while they continue to give their local subscribers such execrable service?"

The reporters and editors miss the point. The secret of the exhibit at the Lenox Lyceum is that it is essentially a "long distance" exhibit. Metallic circuit construction is what makes all the difference. To compare local grounded circuit service with that offered by the long distance metallic circuit system is like comparing the elevated railways with the Pennsylvania Rail Road. Metallic circuit construction is to telephony what a solidly built track and first-class locomotives are to railroad travel.

For long distance telephony the use of metallic circuits throughout is absolutely essential and the plant and charges of the company are arranged accordingly. Users of the long distance system appreciate the service and pay the high charges without grumbling. For local systems metallic circuit working was not at first considered necessary and, consequently, the standard of construction has not been so high as is desirable and is now very generally being adopted. Telephony having been first established with grounded circuits, the business has developed so rapidly that most telephone companies have had all they could do to keep up with extensions, and postponed the alteration of their entire plants as long as possible.

However, a new era is dawning. Improved telephony, like rapid transit, for this congested city, is approaching, and is even now attainable by those who are willing to pay for metallic circuit service. The improvement, as we have said before, does not depend upon the wonderful inventions which are occasionally hinted at by imaginative reporters as being kept concealed and hidden away by the Bell Company; it depends upon the adoption of metallic circuit working. Does any newspaper editor ever stop to count the cost of such a change, or does he consider what it means to double the wires and reconstruct the switching plant, to say nothing of increased expense of operating, for eight or ten thousand subscribers? And does he trouble his mind as to whether the subscribers are willing to help pay the piper for revolutionizing an immense plant, even in exchange for improved service? Certainly not. He prefers to dole out the mysterious paragraphs alluding to the wonderful inventions kept hermetically sealed in burglar and reporter-proof vaults by the iniquitous Bell Telephone Company.

HOW WOULD KEMMLER HAVE FARED?

If the following extract from the Oswego *Palladium* is a correct version of what happened, the feelings of the electrocution experts must have received a very considerable shock:

"It may be remembered that after the papers staying Kemmler's death had been served on Warden Durston, a calf was procured as a substitute, to illustrate how the electrical apparatus would have worked. The calf, which was well grown, was placed in position, the full current which was intended for Kemmler was turned on, and the calf was dead in an instant; and according to the story of Dr. McDonald, as related to a *Palladium* reporter, the room was also instantly filled with the odor of burning hair and flesh, which quickly drove the occupants out of the door. The electric current, it is said, was on but an instant, but in that time the calf was fairly roasted alive."

If a scene such as this had taken place, with Kemmler for the principal character, it is certain that such a wave of disgust and indignation would have swept through the country, that the objectionable law responsible for it would have to be crossed from the statute book forthwith. And what security can the framers of the law, and those intrusted with its practical execution, offer that such a scene shall not be enacted, if the legal taking off of human beings by electricity is ever attempted?

CORRESPONDENCE.

Electrical Happenings in Chicago, Boston and Washington.

OUR CHICAGO LETTER.

Mr. Geo. W. Vernor, formerly auditor of the Telephone and Telegraph Construction Company, of Detroit, Mich., has purchased an interest in the Southern Electrical Supply Company, of St. Louis, and will be elected to the position of secretary or treasurer at the next meeting.

The Laclede Car Company, of St. Louis, has closed contracts to furnish motor cars for the following street railway companies: 120 motor cars to Minneapolis Street Railway Co., cars to be equipped with Bemis trucks; Streator Railway Co., Streator, Ill., 10 cars; Duluth Street Railway Co., 12 motor cars.

Mr. H. D. Sexton has secured a franchise for an electric street railway in East St. Louis. The franchise was granted by the council at the meeting held Monday evening.

The Pond Engineering Company will furnish the Streator Electric Railway Company, at Streator, Ill., with a complete steam plant, including two 125 horse-power Armington & Sims engines, Hoppes feed water heater, pipes, pumps, etc. The above company's Kansas City office report large sales, among which is a 100 horse-power Armington & Sims engine for the Washington apartment house. The popularity of the Sheffield grate bars and standard rocking grates is steadily on the increase and large sales are reported.

Mr. W. P. Adams, lately with the Thomson-Houston Electric Company in their Boston office, has located in Chicago, and will join forces with Mr. J. E. Wilson in looking after the interests of the J. A. Grant Engine Company.

Mr. George Cutter has closed a contract to furnish the wire for the electric plant which will be installed in Hannah & Hogg's theatre and saloon, on Madison street. "Simplex" will be used throughout.

The Sprague Electric Company have secured the contract to equip the Greenwood and Greenlong street railway, at Columbus, Ohio, with four motor cars. The road will be five miles in length.

Personal.—Mr. P. C. Burns, of the Findlay Glass and Carbon Company, Findlay, Ohio, and Mr. Rose of the Rose Electric Light Supply Company, St. Louis, Mo., were among the recent visitors at the Western office of the REVIEW.

The next meeting of the Chicago Electric Club will be held on Monday evening, May 19th. D. B. D.

Chicago, Ill., May 10th.

OUR BOSTON LETTER.

The Dennison Electrical Manufacturing Company, manufacturers of electrical supplies, conductors and insulated electrical cables, have purchased the factory and its entire machinery equipment of the Goodyear Rubber Company, Providence, R. I.

Within a fortnight this new enterprise will be under full headway, and by the middle of May, will have their wire and cable product ready for the market. The company will manufacture under the patents of Mr. Russell A. Dennison. The patentee is the president of the corporation, and he has associated with himself several wealthy and influential New England business men.

Manchester (N. H.) Electric Light Company is building an extensive addition to its station. All the small engines will be replaced by a 500 horse-power compound condensing engine.

The L. F. Jordan Train Lighting Company, of this city, has its system in successful operation on a train of the Connecticut Valley Railroad. The Jordan Company's offices are at No. 85 Water street.

The Economic Electric Company has started up its business with the most favorable of prospects. Its factory is at Brockton, Mass., and principal offices in the Albion building, corner Fremont and Beacon streets, this city.

The Spencer Damper Regulator continues to increase in number of sales among the electric lighting stations and plants. Mr. G. G. Stillman, of this city, the New England agent of this popular apparatus, reports recent sales of the regulator to the following: Millbury, Mass., Electric Light Company; American Electrical Works, Providence, R. I.; and Coney Island and Brooklyn Railway Company, Brooklyn, N. Y.

The Collett Car Company, of this city, is a recently organized corporation. It will manufacture a newly patented brake for street cars (electric or other power), the feature of this brake being its rapid action, controlled by a quick revolving handle. The West End Railway Company, of this city, has adopted the brake for use on its electric cars.

The Inter-Continental Telephone Company, recently absorbed by the Tropical American Telephone Company, has nearly a thousand subscribers in Caracas, Venezuela, S. A., and has orders in hand for 300 additional customers.

Mr. R. T. White, of this city, has just returned from a week's trip in New York and Pennsylvania. While at Scranton, Pa., Mr. White made arrangements with the Lackawanna Iron and Coal Company to prepare for the market the "White" channel form girder rail, and also the "White" side bearing girder rail.

The National Telephone Manufacturing Company, through politeness of its general manager, Mr. J. B. Bennett, reports the demand for non-electric telephones (acoustic) steadily increasing, particularly among the large manufacturing centers of New England. The company is daily in receipt of orders for the Bennett telephone.

The Gethins Electrical Manufacturing Company, of this city, has already established an excellent reputation throughout the country, owing to the efficient gravity battery it has put in the market. Many fire alarms and police signal systems have adopted the Gethins gravity battery with satisfactory results. The company's battery has recently received testimonials from Mr. Henry A. Chase, electrician of the Boston Police Signal Service, and Mr. H. R. Miller, of the South Framingham Fire Alarm Company.

Simplex Anti-Induction Wire is attracting attention and favorable comment wherever it has been introduced; and as its peculiar merits become more generally known, there will be a popular verdict in behalf of its adoption to insure improved telephone service. The Pleasant Valley Electric Street Railway Company, Pittsburgh, Pa., recently ordered 10½ miles of Simplex anti-induction wire for its private telephone use, this wire to be strung on the same iron poles which convey the company's power lines. An idea may be had of this company's private telephone system from the fact that it has 14 sub-stations connected up with a perfectly equipped central station at company's headquarters. The St. Louis Electric Light and Power Company, has been using, for some time, the Simplex anti-induction wire on a section of its private telephone service, and are so well pleased with the results, that another supply has been ordered, to enable the company to equip its entire system with the wire alluded to.

The private telephone line between the Hathaway Building and the offices of the Government Paint Company (nearly a mile in length) has given uninterrupted satisfaction from the day it was first put into use. This line is also constructed with Simplex anti-induction wire.

Electric Stocks.—Boston quotations at closing hour of the Exchange, Saturday, May 10, were as follows:

Thomson-Houston Electric Company	53½.
" " " " Preferred.	25⅝.
" " " " Series C..	17.
" " " " Series D .	7⅝.
Thomson Electric Welding Co	245.
" European Welding Co	115.
Westinghouse Electric Co	40.
Fort Wayne Electric Co	14.
Lynn Gas and Electric Co	150.
Edison Phonograph Doll Co	4.
TELEPHONE:	
American Bell	225.
Erie	41½.
New England	52¾.
Mexican	90½
Tropical American	1.25.
National Tel. Mfg. Co. (acoustic)	.65

Boston, May 10, 1890. W. I B.

OUR WASHINGTON LETTER.

The Metropolitan Street Railway is about five miles long, runs through the busiest streets of Washington, is exceedingly crooked, and has heavy grades in many places. The motive power problem has long been a serious one, and President Pearson and his associates have given it much study. A year ago they reached the conclusion that some substitute for horse-power must be found. The nature of the road made the use of cable or overhead electric lines impossible; no underground electric system gave any hope of successful operation and some independent motor appeared to be a necessity. The company, therefore, determined to test the storage battery system, on its own account and at its own expense. After investigating all the proposed systems, it finally secured the services of Engineer C. O. Mailloux, and for some months past he has been busily engaged in devising machinery and fitting up an experimental car. In the course of ten days or two weeks he expects to have it ready for trial on the main road. Tests so far made give reason for the belief that it will, eventually, prove a success. The car is fitted with 120 cells of storage batteries of the Faure type, made by the Electrical Accumulator Company, of New York, with an extra set of the same number, and is driven by two 12 horse-power slow speed motors of a new pattern, invented by Mr. Mailloux. The gearing is also the invention of that gentleman and embraces some novel features, the details of which are not to be made public until applications for patents are acted upon.

The Senate and House of Representatives are not entirely in accord on the question of authorizing the laying of wires in the streets of Washington, and there are indications that some plan of placing the matter in the hands of a subway commission will be adopted. There is great need of some systematic method of dealing with the problem.

Washington Has a Contest over the three-wire question. Mr. Wash. McLean built a large hotel a year ago, now the popular "Normandie," and had it wired for incandescent lights, during construction, according to the three-wire system. Now they find they can purchase some other than the Edison dynamo to advantage, and propose to make changes in the wires, necessary to allow its use. The Edison Company claims that this will be an infringement of their patents, and an appeal to the courts is in prospect. G. C. M.

Washington, D. C., May 10.

Electric Lighting of Chelmsford.

On the 21st ult., says our esteemed English namesake, there was formally inaugurated the public lighting of Chelmsford, England, for although the town has been lighted by electricity for some weeks past, it was only on that day that the corporation dated the commencement of their contract with Messrs. Crompton & Company, Limited, and officially recognized the improvement brought about in their streets by the substitution of electric in the place of the old gas light.

Chelmsford, quiet and unobtrusive country town as it is, has set an example which might be, with advantage, followed in other places, and it can boast, certainly with some justification, of being the only one in this country where throughout its whole area gas has been superseded by its more modern rival. In inception, in maturing, and in its successful accomplishment, the scheme for this installation has been the work of its own inhabitants and manufacturers, who have carried out the matter with the minimum of assistance from extraneous sources. But the electric light is there; how marked a contrast to the fate of schemes for the proposed lighting of several other cities we might mention, where the sole result apparently reached has been the complete waste of time, energy and money on the part of the unfortunate electrical engineers, who foolishly were induced to submit their tenders. Improvement had to recede in presence of the vested or gas interest. Even at Chelmsford this latter power had to be overcome, not without a hard fight, while the rancor thereby engendered has scarcely yet passed away. The opposition might not have been so readily subdued had not Messrs. Crompton & Company, who have extensive works in the town, met the municipal authorities on almost all points, and entered into a contract with them for the supply of public lighting for five years, at a price which alone can hardly be remunerative. A clause in the contract enables Messrs. Crompton & Company to provide private lighting for such persons as may require it, and it is to be hoped that the charge per unit may be fixed at a sum sufficient to produce a profit, provided that the townspeople do not prove niggardly in their consumption of the electric current. At the end of five years, if the corporation do not renew the contract for public lighting, the contractors still have the right to supply private wants for another five years. Their contract was accepted by the town council on March 27th last year, the work was immediately put in hand, and the lighting was to have commenced on September 8th. Through a difficulty in getting the materials, however, and the numerous alterations in the original scheme insisted upon by the Board of Trade inspector, great delays occurred, and the work was not finished till about a month ago. The three main streets of the town are lighted by means of 18 arc lamps, for each of which the town council is to £22 10*s.* per annum, and the other streets by 210 incandescent lamps, for each of which the charge will be £2 6*s*, 10*d.*, the total annual cost thus being £873 6*s.* 8*d.* This is against £768 formerly paid to the gas company for only 188 lamps. The contract is for five years. There is to be a fine of 4*d.* per hour for every arc lamp which goes out, and ½*d.* an hour for every incandescent lamp. A breakdown is guarded against by reserve machinery, but if the light should fail, Messrs. Crompton will be liable to a fine of £500. A Board of Trade license has been applied for by the firm.

The steam engines and dynamos forming the generating plant are located at Messrs. Crompton & Company's works, a portion of which premises has been set apart for public lighting purposes. The distributing mains, mostly carried overhead, are of Silvertown manufacture, and these cables are suspended from steel wire stretchers from pole to pole. The distance between each pole never being more than 80 yards—the normal interval selected here for placing arc lamps—while the exigencies of construction and the difficulty of spacing the poles to meet the views of the Board of Trade, having rendered it compulsory for the contractors to use a greater number of poles than would ordinarily be required, conduce to produce a rigid and horizontal appearance in the wires not without attendant advantages in other respects.

Strenuous opposition was offered to the overhead system. Its lesser cost for erection and maintenance in a somewhat straggling area like Chelmsford, however, gained the day over the advocates for underground distribution. To comply with the Board of Trade rules that no main wires shall be placed at a less distance than six feet from any building, the mains, owing to the narrowness of the sidewalks, had to be erected on suitable wrought iron brackets attached to the poles, extending over the roadway, away from the houses. The arc lamps lighting the most important streets, are worked from a continuous current machine. The remainder of the streets are lighted by incandescent lamps, the distribution of the electrical energy being by alternating currents of high potential, converted by transformers into currents of low tension; the transformers are placed on the poles carrying the overhead wires. The transformer system is also to be used for the private supply. The 210 incandescent lamps scattered along the less important parts of the town, are of 32 candle-power, and although incandescent lamps are not considered the best means for lighting streets, they seem in this case to give general satisfaction, the consensus of opinion being that they produce a better effect than the displaced gas lamps. All the glow lamps are worked at a transformed pressure of 100 volts.

The practical success of the installation has been achieved through the untiring zeal of Messrs. Crompton and Company's engineers, more particularly, perhaps, Mr. A. J. Pott, who has made it his special study, and whose duties during the course of operations cannot have been a mere sinecure, when one considers the numerous difficulties connected with electrical engineering sure to arise, and putting on one side the manifold troubles in regard to way-leaves and disputes with the Board of Trade.

The inauguration of the town lighting took place just before seven o'clock, in the presence of the Mayor and a large concourse of people, when the lights were switched on by the Mayoress (Miss Brown) and the ex-Mayoress (Mrs. Chancellor). To celebrate the event a public dinner was afterwards held at the Saracen's Head Hotel, the Mayor (Alderman J. S. Brown), chairman of the electric lighting committee, presiding; and among the guests present were several members of the corporations of Chelmsford and other towns, Mr. R. E. Crompton, Mr. Spagnoletti and other distinguished electrical engineers. In the course of the after-dinner speeches, the town was congratulated upon being the first in the country lighted throughout by electricity.

C. J. H. Woodbury, of Boston, recently lectured before the class in electrical engineering, at the Massachusetts Institute of Technology, the subject being upon the essentials necessary for protection against fire in the installation and operating electric lighting and power plants.

A peculiar experiment was performed the other day at the Deptford central station, London. The Board of Trade had expressed the opinion that in the event of a workman cutting M. Ferranti's 10,000 volt concentric cable he would be in danger of losing his life. In order to prove the contention of the company's engineers that such would not be the case, the following experiment was carried out before a deputation from London. A length of the main was charged with the 10,000 volt current and the main was then cut through by a workman with a hammer and Smith's set. No effect was noticed by the workman; the main was, of course, short-circuited and the fuse blew out, but that was all. We should not have cared to be in the operator's place, all the same, and, moreover, we do not see that the experiment proved very much. If either of the conductors had happened to be grounded (as might occur in actual practice, say, at a transformer), we imagine that the effect on the workman would have been somewhat different. In the words of Bret Harte, "the subsequent proceedings would have interested him no more."

*** Chicago retail druggists expect to adopt the long-distance telephone.

*** The St. Paul telephone exchange will soon move into new and larger quarters.

*** The New England Telephone Company had 91 exchanges and 17,275 subscribers the first of the year.

*** The New England Telephone and Telegraph Company are building a new telephone line from Boston to Fitchburg and also from Haverhill to Salem, Mass.

*** If dividend No. 26, to be declared by the Erie directors, is, as is expected, one per cent., the company will have paid, including this dividend, $900,000 in dividends. A mathematician figures that purchasers of Erie at the average price the stock was originally sold at, namely, $55 per share, have received over five per cent. upon their investment from the beginning. The present rate of dividend will soon bring the average on the $55 basis to a sum exceeding six per cent. Not so bad an investment after all.—*Lowell Citizen.*

The Tropical Telephone Company.

The Inter-Continental Telephone Company has sold its telephonic business in Venezuela to a strong syndicate of English, Amsterdam and Paris capitalists, for about £30,000. Venezuela had over 1,250 paying subscribers in its system and was earning seven per cent. on $200,000. The new company, the Venezuela Telephone and Electrical Appliances Company, Limited, of London, undertakes to extend the business and has taken over the Tropical American Telephone Company's contract, and already purchased about £7,500 of supplies, and expects to expend about £10,000 more during the present year—all this business comes to the Tropical American Telephone Company.

This is the field where the "American Telephone Company, Consolidated," attempted to do a business in competition under an alleged concession from the Venezuela government, and which company raised something like $100,000 with Hon. Benj. Butterworth as president. When the true facts were shown, Mr. Butterworth resigned.

The new English company will brook no competition or interference, and the English government will allow no injustice through duplicate concessions. Mr. Derrom, the old manager for the Boston concern, takes charge of the business of the new company. He arrived in Boston Monday, the 5th inst., and as soon as the sale is closed and money paid, sails for London, probably on the 12th inst.

The Inter-Continental Company expended about $125,000 in its Venezuela plant; its shares are held by very few, mostly officers of the Tropical American Telephone Company, which company is a large shareholder and will realize handsomely from the sale, besides retaining a good customer in the English company.

The Pan-Electric Case.

In 1883, J. Harris Rogers, having made a large number of inventions relating to electric light, telegraphs, telephones and kindred subjects, some of them patented and others under examination in the Patent Office, joined with Gen. Joseph E. Johnston, Attorney-General Garland, Senator Isham G. Harris, Hon. Casey Young and Indian Commissioner J. D. C. Atkins, in forming an association, "planted on the possibilities of electricity," under an agreement to organize a corporation strong enough, in capital, influence and character, to develop and control, not only the business covered by the Rogers' patents, but, substantially, the whole electrical industry of the country. The father of the inventor, Dr. J. Webb Rogers, was, and always has been, the leader and principal business man in all the pan-electric affairs. He is very talented and enthusiastic, some say visionary, but he is always candid—and never more candid than when, before the association was formed, he requested and urged his associates not to take his opinions as to the value of the inventions, but to have them thoroughly investigated by their own electricians, experts and lawyers.

The agreement to organize a general company to carry on all branches of the business was not fulfilled, but two sub-companies were formed to exploit the telegraph and the telephone business. The incorporators and stockholders of these companies were the same persons who formed the association, and the understanding was that the money derived from the sale of stock in the two sub-companies was to be used in developing the other inventions belonging to the parent organization. At this juncture Senator Harris and the other statesmen in the association experienced grave doubts in regard to the value of the inventions, which, up to that time, they believed were of immense value, and concluded that it would not be consistent with their high character and sense of honor to put their names to certificates of stock, the sale of which might be an imposition on the public. Notwithstanding the conscientious scruples of these gentlemen, they sold telephone state rights under contracts which bound the licensees to organize companies, sell stock and pay them a portion of the proceeds. From these sources large sums of money were received, divided among the associates, and appropriated to their personal use. Then they refused to have anything more to do with the business, and Rogers brought the suit which was decided in the District of Columbia Supreme Court, as stated recently in the REVIEW. He claimed that the failure of the association to organize a general company, under a comprehensive charter, issue stock, test the inventions and prosecute the business, had caused him great loss, and he asked the court to award him suitable damages. The court decided that, as Rogers had assented to the change of plan by which subcompanies were formed to prosecute portions of the business, he had no ground of complaint on that point.

Rogers also claimed that all the money and stock dividends received from the local telephone companies belonged to him, inasmuch as the defendants had done nothing to aid the enterprise, and asked that they be made to account for the receipts in money and stock. The decision was that the dividends declared by the telephone company, which disposed of all the receipts, was a settlement of the account, and that Rogers had no further claim on the defendants as members of the association, but that he might have a claim against them as stockholders in the sub-companies. He will soon commence suits against both the Pan-Electric Telegraph Company and the Pan-Electric Telephone Company.

The court decided that the defendants must re-assign to Rogers all the patents except those transferred to the telegraph and telephone companies, and disposed of the charge of conspiracy with the assertion that no evidence had been produced to prove that they had done anything inconsistent with integrity and good faith.

Judge Cox, in discussing the case, referred to the famous Pan-Electric prospectus as a highly colored and extraordinary manifesto, and said he could not conceive that the distinguished defendants would have put their names to such a document, but the plain fact is, their names were put to it, they paid for the printing, frequently discussed its contents, and distributed many copies among prospective investors in their promising scheme.

A Telephone Enterprise.

The telephone, from a commercial as well as a domestic standpoint, has proved itself to be an important factor in the daily routine of most business men, not only at their offices but at home; and, notwithstanding an occasional delay or annoyance from induction, it stands pre-eminent to-day as an invaluable and indispensable commodity.

Perhaps there are not many who are cognizant of the fact that the telephone has come into commercial use to such an extent that several large corporations have central offices of their own, by which one may talk anywhere within the system of the company or connect up with the outside world.

The Thomson-Houston Electric Company, Boston, Mass., has a central telephone office, and has three metallic circuits (Nos. 3055, 3056 and 3057) between its offices in the "Hathaway" and "New England" Buildings and the headquarters of the New England Telephone and Telegraph Company. The first named corporation has also a metallic circuit switchboard which was specially arranged and constructed for its use, having a capacity of 50 lines and holds 30 drops. It has also a private line, copper metallic circuit, between the principal Boston office and its manufacturing establishment at Lynn, Mass. At the company's Boston office there are also 20 instruments (six for long distance and 14 for ordinary use), any of which may be used for the purpose of conversing about the company's offices, and for all local and long distance talking.

The equipment of this model central telephone station was put in under the supervision of Mr. Wm. J. Denver, assistant general manager of the New England Telephone and Telegraph Company, and his skillful arrangement of the switchboard, instruments and circuits of the system, has given thorough satisfaction to the officers of the Thomson-Houston Electric Company.

The New England Telephone and Telegraph Company.

The annual meeting of the stockholders of this company was held in New York city, at 18 Cortlandt street, May 5th.

The report of President Thos. Sherwin for the year ending December 31st, was as follows:

As shown by the treasurer's statement appended, the

Gross earnings for the year were	$1,255,570 62
Expenses	957,305 35
Net earnings	298,265 27

As compared with the results for 1888, there was

An increase of gross earnings	$128,263 22
An increase of expenses	100,724 48
An increase of net earnings	27,538 74

In each of the regular classes of revenue there has been a substantial increase, and as in former years, the directors have considered it advisable to appropriate a liberal amount from the earnings to carry forward the work of reconstruction. A large amount of work has been done in the refitting of exchange offices, rebuilding of extra-territorial lines, and replacing of open wires with cables.

Important additions have been made to the underground system, in Boston, Cambridge and Lowell, and, following our established practice, a portion of the cost of this work has been charged to expense, under the head of reconstruction. The system of connecting lines between our exchanges has also been largely extended.

Of the total amount charged to new construction, $318,169.17, $190,000 has been expended for underground work, and $88,000 for extension of the extra-territorial and toll lines. * * * *

Total conduit constructed in 1889, 27,978 feet, containing 239,334 feet of duct. The underground system in Boston now consists of 73,752 feet of conduit, the total length of duct being 733,949 feet, or about 139 miles, with capacity for about 16,000 miles of single conductor. Within the limited distances over which the underground wires are used, they are found to work satisfactorily.

During the year cables have been drawn into the ducts as follows:

418 feet,	200 conductor.
3,876 feet,	130 conductor.
103,608 feet,	120 conductor.
2,623 feet,	100 conductor.
1,440 feet,	50 conductor.

Of submarine cable there has been laid in Boston:

540 feet,	50 conductor.
5,510 feet,	26 conductor.
1,420 feet,	24 conductor.

Of aerial cable there has been hung:

1,200 feet,	60 conductor.
564 feet,	50 conductor.
1,845 feet,	40 conductor.
635 feet,	30 conductor.
560 feet,	20 conductor.
166 feet of various kinds.	

The total length of new cable, of all classes, placed in use in the Boston exchange during 1889, is 124,405 feet. The length of underground wire reported in use at the close of the year was 3,599 miles, or about two thirds of the entire amount employed in operating the exchange.

In the use of this system, the Boston exchange now stands second among all the exchanges in the country, New York being the only city in which a greater mileage of underground wire is in operation for telephonic purposes.

The company has now in use in its various exchanges, 446,470 feet of cable, aerial, submarine and underground, carrying 6,600 miles of copper wire.

Under the ordinance passed by the city of Lowell, conduits have been laid in that city as follows:

In Central street, 1,187 feet of conduit, containing 14,034 feet of duct.

In Market street, 1,401 feet of conduit, 8,407 feet of duct.

In Middlesex street, 2,508 feet of conduit, 18,224 feet of duct.

In Cambridge there has been laid:

In Main street, 3,561 feet of conduit, 47,988 feet of duct.

In Pleasant street, 274 feet of conduit, 1,645 feet of duct.

The inventory of supplies purchased during the year includes 1,363 bells, costing $10,553.07; 122,173 feet of cable, $83,808.64; batteries and battery material, $4,922.79; 27,532 cross arms, $8,074.63; 168,308 insulators, $3,256.38; 10,468 poles, $31,003.55; switchboards and material therefor, $9,951.41; 335 tons of wire of all kinds, $65,229.41; 362,004 feet of iron pipe for underground conduits, $51,288.31; with other material of various classification, making the total cost of supplies purchased, $300,199.24, as against $203,279.95 for the previous year.

In addition to the above, 2,550 magneto bells have been refitted at a cost of $6,232.35.

The exchanges at Bangor, Chelsea, Haverhill, Holyoke and North Adams, have been furnished with multiple switchboards; those at Gloucester, Hyde Park, Medford, St. Albans and Waltham, have been newly equipped with boards of different pattern.

Additions have been made to the Boston, Springfield and Worcester switchboards, to provide for the growing business of those offices.

In the reconstruction of extra-territorial and toll lines, and extending the long line system, poles have been placed and wire strung as follows:

LINES.	Poles.	Miles of Iron Wire.	Miles of Copper Wire.
Bellows Falls and Newport, N. H.	229		
Bellows Falls and Rutland	164	16	
Baldwinsville & Winchendon	290		
Boston and Gloucester	525	15	84
Boston and Lowell	753	8	113
Boston and Lawrence	380	4	
Boston and Portsmouth, via Lynn, Salem and Newburyport	930	19	40
Boston and Worcester			492
Boston and Salem			34
Brattleboro and Bellows Falls	509		
Coltsville and Dalton, Mass.	88		
East Boston and Lynn			40
East Boston and Salem			5
Fitchburg and No. Adams	2,801	86	20
Keene and Chesterfield	334	6	
Lowell and Nashua			30
Manchester and Concord, N. H.	758	6	
Milton and Canton	45		
Mechanic Falls and So. Paris, Me.	418	16	
North Adams and Stamford, Vt.	122		
Pittsfield and Lenox	46		
Pittsfield and No. Adams	529	5	
Pittsfield and Pontoosuc	50		
Pittsfield and Springfield	5	3	
Scarboro' and Prout's Neck, Me.	130	4	
Shelburne Falls and Coleraine	35		
Springfield and Chicopee	68		
Springfield and Worcester	28	1	
Tenants' Harbor and Port Clyde, Me.	151	5	
Woburn and Reading	278	10	
	9,866	204	858

The expenditure upon the plant and equipment during the year has been:

For construction, including bells and long distance desk sets	$331,191 94
For reconstruction	106,956 52
For repairs	216,289 55
	$654,438 01
As against an expenditure for 1888 of	$468,157 82

The mileage of exchange wires, December 31, 1889, was:

On poles	14,261 miles.
On buildings	1,837 "
Underground	3,608 "
Submarine	88 "
	19,784 miles.

	Dec. 31, 1888.	Dec. 31, 1889.	Inc.
Exchange subscribers	15,336	16,519	1,183
Express subscribers	549	556	7
Private line and agency stations	2,847	3,178	331
	18,932	20,453	1,521
The increase in the number of stations during 1888 was			1,576

To effect the increase of 1,190 in the number of exchange and express subscribers, as shown by the foregoing statement:

New subscribers have been connected	4,731
Subscribers have been disconnected	3,541
	1,190
The extra-territorial lines number	76
Miles of extra-territorial pole lines	2,180
Miles of extra-territorial wire	5,048

The number of regular employés of all classes is 554.

The average number of local exchange connections daily, in all the exchanges of the company, is 94,852, or an aggregate for the year of some 32,000,000.

The average number of calls per subscriber daily is 5⅔, the number varying from four in the smaller exchanges to 10 in the principal office in Boston.

The daily average of extra-territorial and toll messages is 1,447, a yearly aggregate of about 500,000.

The electrical department has been occupied during the year in making the usual electrical measurements and tests of cables, exchange lines and apparatus, and in the study and application of devices to prevent interference from strong currents employed upon the wires of other companies, in proximity to our own. The new switchboards have all been planned by this department, each with reference to the particular exchange in which it was to be placed, and drawings in detail made for their entire equipment.

A system of general electrical inspection has been established during the year. Three inspectors are employed under the direct charge of the electrician, who visit the various exchanges, making the necessary tests to discover and remedy defects.

Patent 413,276 was issued to the company, October 22, 1889, for "Central Station Calling Apparatus," invented by Mr. Farnham.

Applications have also been made for patents on a new form of underground cable covering, and a double trolley crossing switch.

The trouble which we have experienced from electric light induction has in many localities been lessened by the separation, by as great distance as possible, of the telephone and electric light wires, and by the running of the lighting wires in return circuits, electrically balanced so far as practicable.

The recent application of electric power to the propelling of street cars, in some of the cities in which the company is operating exchanges, has introduced a new and serious

trouble, resulting from the influence of the strong electric current upon our lines. In every city where permission has been given by the municipal authorities for the use of electricity upon the street car lines, this company has entered its protest against the use of the single trolley system, productive as it is of inconvenience to our subscribers in the use of their telephones, and fraught with danger to life and property.

In Cambridge, and in portions of Quincy and Boston, where the wires of the street railways parallel our own, we have endeavored to obviate the trouble by removing the grounds at subscribers' stations, and connecting the lines in groups to a return conductor of large conductivity. This device has effected a partial remedy, by preventing the conduction of the strong current to our wires through the ground, but it does not remove the trouble from induction.

Unless the street railway companies shall adopt a better system for applying the electrical force, this trouble will continue, and perhaps extend. To adapt our plant to the general use of metallic circuits would involve the replacing of our pole lines by those of greater height and twice the carrying capacity, the doubling of wires, alteration in the form of aerial cables, and other changes calling for large expenditure of money, and requiring several years for their completion.

In most of the large exchanges, the company has now facilities for connecting a limited number of its subscribers by metallic loops, and several hundred subscribers, especially those who have occasion to make large use of our extra-territorial lines, have already been connected in this manner, securing the improved long line service, and exemption from strong current interference, and paying the increased rates which the company is obliged to charge for this more costly kind of equipment.

In view of the many objections which exist to the present crude method of using electricity with the single trolley, for the moving of street cars, the judgment of competent electricians may confidently be accepted, that this will give way to some one of the other methods, by which the electric current may be applied as effectively as a motive power, without causing injury to the telephone service, or menacing the safety of property and life.

Notice has been served upon the several companies operating, or indicating the intention to operate, the single trolley system upon their roads, in proximity to our wires, that the use of the electric current applied in that way is injurious to our business, and an invasion of our rights, and that we shall hold them responsible for any damage to our interests resulting from that cause. It is the purpose of the management to employ such means as may be necessary, to obtain relief from disturbance of this nature, and redress for the injury which we may suffer.

In the engineer's department, progress has been made in the work of preparing accurate maps of the locations of poles and structures in the numerous cities and towns through which our lines run. The making of plans for underground work and supervision of the conduit construction have also been in charge of this department.

In the Lynn exchange, the office and its contents, except the multiple switchboard, together with a considerable amount of our outside property, were destroyed in the great fire in that city, on November 26th last. The loss was about $4,000.00.

Within an hour from the vacating of the office, connection with Boston and other points was again established, and the wires were kept in use during the continuance of the fire, rendering the city authorities a service of great importance at that critical time. The exchange has since been operated in temporary quarters, and has now regained nearly its former number of 600 subscribers.

With the large growth, during the past five years, in the business of the principal exchange in Boston, the company's offices and operating room, at No. 50 Pearl street, have become quite inadequate for its needs. It is expected that before the close of the present year, the exchange will be in operation in the building of the American Bell Telephone Company, now in process of erection, where your directors have taken steps to secure accommodations suited to the requirements of this important exchange.

The affairs of the company have never been in more prosperous condition than at present, and all indications point to continued growth and to larger returns from the operation of your property.

The extensions of the plant have been of such character as to enlarge its earning capacity, and ensure permanence to the business.

Since the close of the year, it has been deemed advisable to make a second issue of $500,000 of ten year six per cent. bonds, of the same character as those previously issued, and these bonds have now been sold, to provide funds for carrying forward the necessary extension of the property.

During the year 1889 there has been paid in dividends, $270,726.53.

The following is an estimate of the cost of maintenance and extension of the plant for the year 1890:

For construction	$350,000
For reconstruction	100,000
For repairs	200,000
	$650,000

COMPARATIVE STATEMENT OF EARNINGS AND EXPENSES.

Earnings.

	1888.	1889.
Agency	$45,190 63	$47,584 79
Exchange	946,664 79	1,045,854 67
Extra-territorial and toll line	102,246 28	121,864 61
Miscellaneous	9,372 15	7,863 45
Private line	22,077 35	30,576 33
Telegraph commissions	1,756 20	1,826 72
	$1,127,307 40	$1,255,570 62

Expenses.

Expenses of repairs and maintenance	$198,421 76	$216,289 55
General expenses	60,888 25	96,239 17
Instrument rental	223,210 99	241,756 31
Insurance and taxes	50,181 25	54,915 67
Interest	2,415 44	22,337 21
Miscellaneous	11,348 83	4,852 64
Operating	166,555 29	176,881 32
Postage, printing and stationery	10,721 55	11,248 06
Rebates	17,341 85	9,179 51
Reconstruction	98,983 40	106,956 52
Rents	16,512 26	17,649 39
	$856,580 87	$957,305 35
Net earnings	$270,726 53	$298,265 27
Undivided earnings, December 31, 1888		$113,226 53
Net earnings of 1889		298,265 27
		$411,491 80
Dividends paid in 1889		270,726 53
Undivided earnings, December 31, 1889		$140,765 27
Surplus account, January 1, 1889		$373,525 72
Adjustments		11,250 00
Surplus account, December 31, 1889		$362,275 72

LEDGER BALANCES, DECEMBER 31, 1889.

Debtors.

Licenses	$4,268,000 00
Plant	6,349,860 12
Unissued stock	1,605,400 00
Trustee stock	231,000 00
Stocks and bonds	29,116 90
Construction (for the year 1890)	318,169 17
Office furniture, teams and tools	22,951 49
Bells, material and supplies	218,354 80
Accounts receivable	169,879 01
Cash	18,989 70

Creditors.

Capital stock	$12,000,000 00
Surplus account	362,275 72
Income account	140,765 27
Reserve account	153,213 23
Unpaid dividends	1,150 25
Bills and accounts payable	74,316 72
Loan of 1889	500,000 00
	$13,231,721 19 $13,231,721 19

Net gain of agency subscribers for the year 1889, 331
" " " exchange " " " 1,190

WM. R. DRIVER, *Treasurer.*

The former directors were elected, as follows: Frederick Ayer, Henry S. Hyde, Benj. C. Dean, Albert O. Morgan, Wm. H. Forbes, Moses G. Parker, John E. Hudson, Stephen Salisbury, Thomas Sherwin.

At the meeting of the directors upon the adjournment of the stockholders' meeting, the officers were re-elected as follows: Thos. Sherwin, president; Henry S. Hyde, vice-president; Wm. R. Driver, treasurer; Fred. J. Boynton, secretary and auditor; Jasper N. Keller, general manager.

Saved by the Telegraph Wires.

Peter Murphy was working last week upon the bridge of the New York and Hartford Railroad Company over the Connecticut River, at Warehouse Point, Conn., when he stepped on a loose plank, which tilted with him, and he fell off the bridge. The distance to the river is nearly 40 feet, and the river bed is full of jagged rocks. About 12 feet below the edge of the bridge are the wires of the Western Union Telegraph Company. Upon these Murphy struck. He had presence of mind enough to stretch his arms, and the wires supported him. He balanced in mid-air until two of his companions crawled down upon some of the lower timbers of the bridge and threw a rope out to him. He tied it about his waist and they hauled him in, and the three made their way to the top of the bridge in safety. Murphy did not receive a scratch.

.... A special from San Antonio, Tex., says: L. C. Baker, superintendent of the Western Union at St. Louis, has been here for ten days negotiating with President Lott and Vice-President Yoakum, of the San Antonio & Aransas Pass Railway, for the purchase of the road's telegraph line by the Western Union. Vice-President Yoakum stated that the negotiations had been concluded, and that the lines of the railway would pass into the possession of the Western Union for a consideration of about $100,000.

A New Multiple Relay.

James L. Cutler, of Piketon, Ohio, and Joseph A. Sullivan, of the Cincinnati police telephone department, have recently patented a multiple relay.

The object of the invention is to provide mechanism whereby each of a series of visual, palpable or audible signals at various points on a main circuit, may be operated or called into action from a central station without operating the signals at other points on the same circuit. In other words, by the use of this instrument, any desired station on a circuit of say a dozen or more can be called without the disturbing of the signals at the other points on the line.

From any point on the wire, any desired station on the circuit can be signaled without interfering with the others. The field which the invention is designed to fill is a large one, as it is intended to render possible the successful operation of electric switches, the semaphores used in the block system on railroads for throwing up visual signals from patrol boxes and on telephone lines on which are worked two or more magneto bells. By its use the last station on a line 50 miles long and having a score or more of instruments on it, can be signaled from the station at the other end without the slightest disturbance of the instruments or signals at the intervening points.

All this is done by an arrangement of an electro-magnet and a permutation wheel of hard rubber, on the periphery of which are arranged rows of teeth or pins, so that a panel or moving arm impinges them in passing, a part of the teeth being electrically connected so as to form an electric circuit, which will reset the instrument if any call but the proper one is made.

The arrangement of these teeth may be varied indefinitely, but no two instruments having the same combination can be employed on one circuit, as is the case with the patrol signal boxes and the ordinary A. D. T. call boxes.

The instrument is expected to effect a radical change and greatly facilitate the workings of patrol box systems now in operation in every large city in the country, as the strong feature of it is its ability to throw up a signal at any desired point on a circuit and thereby summon an officer to the patrol box, from which he can be communicated with from headquarters. There is now in operation in a few cities a system of visual signals of the kind referred to, but it has heretofore been impractical for the reason that in order to operate it a direct line had to be strung from each box.

The objection to this is apparent, as miles and miles of wire that would form a network at the office from which they were operated would be formed, to say nothing of the outlay of money that would be required. By use of the multiple relay—one of which must be put in each box, or at every station on the line—it matters not how many there be, the visual signal system can be worked to perfection. A dozen or more electric switches may be connected on one circuit, and can be operated from a tower by the mere manipulation of an ordinary telegraph key.

Another use for which the instrument is designed, and will no doubt prove invaluable, is for the operation of signals or semaphores employed on railroads where the block system is in use. These blocks, as they are called, are the spaces between stations, from which trains are signaled as to whether or not the track is clear. A remarkable feature of the instrument is that by its use only the desired station can respond to its call.

For instance, suppose the signal for Station 3 on a circuit of 10 is two dots and a dash, and Station 5 is two dots a dash and dot, and it is desired to call the latter. The fact that the signal of No. 3 was clicked off in making the call for No. 5 does not in any way affect it, as the instant the last dot of No. 5's call is made the permutation wheel of No. 3 goes back to its place, resetting itself.

.... The Western Union is improving its lines in Salt Lake City and Utah. Supt. Dickey is looking after the work.

TELEGRAPHIC

.... The excellent telegraph department of that great railway system, the Atchison, Topeka and Santa Fe, is under the superintendency of Mr. R. B. Gemmell. His jurisdiction has recently been extended to the lines east of the Missouri river. C. G. Sholes has been appointed assistant superintendent of telegraph, with headquarters at Topeka, Kan.

.... The stockholders of the East Tennessee Telegraph Company met in Nashville last week, at the Western Union office, and selected its old board of directors and officers, with Norvin Green as president. The majority of the stock is owned by the Western Union Telegraph Company, and was represented by Jos. W. Fisher. Most of the remaining stock is owned in Knoxville.

.... The Order of Railway Telegraphers, Division 114, of Macon, Ga., had a meeting last week attended by about 30 members. Messrs. J. D. Rooney, of Hawkinsville, and and J. A. Jeffries, of Wrightsville, were elected as delegates to attend the annual meeting of the grand division of their order, which convenes in New York on June 19. An earnest effort will be made to secure the holding of the next grand division meeting in Macon. If this move is successful it will bring about 2,000 visitors to the city.

.... An important decision was rendered last week by Judge Phelps, at Burlington, Ia., in favor of Hiram Purdy in the suit of the Great Western Telegraph Company *vs.* Hiram Purdy, on unpaid subscription to stock. About 25 years ago the company was organized, and Mr. Purdy, with many other Iowa people, subscribed stock. After paying about 35 per cent. of the stock to which he had subscribed, Mr. Purdy found that the scheme of the telegraph company was fraudulent, and he, with other Iowa subscribers, refused to pay in any more money. The company went to the wall and suit was brought to make the Iowa people pay up. Mr. Purdy's case was a test case for Iowa and will go to the Supreme Court for final settlement.

... Telegraphic communication has been established between New York and Greytown, Nicaragua. A telegram received by the Nicaragua Canal Construction Company reports the arrival at Greytown, of the company's steam tug "H. C. Millward." The route of the telegram announcing the Millward's arrival was by the canal company's line from Greytown to Castillo, on the San Juan River, thence by the Nicaragua government lines to San Juan del Sur, on the Pacific, where these connect with the Central and South American Cable Company's system, thence by cable to Salina Cruz, on the west coast of Mexico, by land wire across the Isthmus of Tehuantepec to Coatzacoalcos, and by cable to Vera Cruz, thence by the Mexican Telegraph Company's cable to Galveston, and over the Western Union wires to New York.

.... Just at present the rival telegraph companies are having a bitter struggle for supremacy at the Pittsburgh Exposition Ball Grounds. The Postal Com. any have the exclusive privilege of putting their wires in at the park, but the Western Union, by wildcatting, has been beating the Postal people in their reports. Just how the Western Union procures their news is a mystery, but with the exception of one day they have been able to serve the pool rooms with the results far in advance of the other company. After the first day's game the Postal Company discovered where their wires had been tapped, but they, of course, at once cut the connection. However, the Western Union continued to get their reports, and the Postal people are now trying to stop them. It is believed that the Western Union have an office on the roof of a house near by.

* * The Charleston Light and Power Company, of Charleston, S. C., has established a motor circuit.

* * A petition, already signed by over 1,000 patrons of the New Bedford, Mass., Street Railway, asking for electric appliances is in circulation.

* * The Birmingham Union Railway Company have been granted a franchise for an electric road by the city. Contracts for machinery has not been closed.

* * The Cincinnati Street Railway Company has commenced to construct the new electric road to Avondale, and the work will be pushed rapidly to completion.

* * The St. Louis Car Company has recently manufactured ten fine electric cars for the electric railway at Indianapolis. The Thomson-Houston system will be used.

* * The electric railway in Muskegon, Mich., is such a complete success that the company has been requested to extend its lines all over the city, and choose its routes.

* * The contract for building the Monet Electric Street Railway, between Quincy, Mass., and Hough's Neck, has been awarded to Messrs. Billingham & Company, of Boston.

* * The Lindel Street Railway Company, St. Louis, have closed a contract with the Sprague-Edison Electric Railway Company, to equip the Washington avenue and Chouteau avenue lines.

* * The Forest Park and Market Street Railway Company, of St. Louis, have filed the bonds required in the ordinances authorizing these lines to change their motor power. It is the intention to employ the overhead system.

* * The Sprague Electric Railway and Motor Company have temporarily discontinued their Philadelphia office. All business will hereafter, until further notice, be conducted directly from their New York office, at 16 and 18 Broad street.

* * By an amendment adopted by the Boston Aldermen, last week, the speed of electric cars may be increased to 12 miles an hour south of West Chester Park; 10 miles an hour between that point and Pleasant street, and seven miles north of Pleasant street.

* * The directors of the Powhattan Railway have determined to adopt electricity as a motive power and are now examining various motors, with a view of securing the best. The Powhattan line runs through a very beautiful section of the suburbs of Baltimore.

* * The ordinance granting the Glenwood and Green Lawn Street Railroad Company the right to lay its tracks a wide gauge and operate its lines with electricity or cable, was passed recently by the Columbus, Ohio, city council. E. K. Stewart and W. W. Franklin are stockholders.

* * The Oshkosh, Wis., Electric Light and Power Company is meeting with much success in canvassing for subscriptions for the purpose of ascertaining the feasibility of establishing an annex to its plant for the transmission of power for motors, for which they have already secured a franchise. There is a large number of factories of the minor order that are using from 10 to 20 horse-power engines that could more conveniently and with less expense substitute motor power, and Mr. C. C. Paige, the general superintendent of the company, is confident that the project will be put through, as indications are very favorable at this time.

* * The Knoxville, Tenn., electric street railway system was put in complete operation last week. The event was celebrated by a large banquet at Lake Ottosee, the terminus of the system, four miles from the city. Speeches and toasts were given by Mayor Kern, M. L. Ross, president of the chamber of commerce, and many other prominent citizens.

* * The Tesla motor is now to be introduced in the coal mines of the State of New York. The management of the Shawmut coal mines has just made a contract with the Westinghouse Electric Company for seven of these alternating current motors and one 30 horse-power generator, this apparatus to be used in connection with the Hercules mining machine.

* * A syndicate of Boston capitalists is said to be negotiating for several street railway systems and franchises in Salem; they have already secured options on the Naumkeag Street Railway. It is further stated that the same syndicate is negotiating for the Beverly & Danvers, and the franchise of the Essex electric roads, which, to some extent, compete with the other lines.

* * In all probability Sioux City will be first in the West to use the storage system of running electric cars. At present the Sioux City Railway Line is operated by the overhead wire system. The Rapid Transit Company, however, which is now constructing the elevated road, will introduce the storage system on its line if this improvement has proven entirely satisfactory by the time they are ready to begin operations.

* * The stockholders of the Harrisburg, Pa., Passenger Railway Company, held their annual meeting last week, and elected the following officers for the ensuing year: President, H. A. Kelker; vice-president, W. K. Alricks; treasurer, Rudolph F. Kelker; directors George W. Reilly, M.D., William R. Gorgas, J. T. Ensminger, J. G. M. Bay, George F. Rohrer, Harris Cohen, George R. Fleming, Lane S. Hart, E. Z. Wallower.

* * Some time since the consolidation of the electric light and power department of the Birmingham, Ala., Gas, Electric Light and Power Company, with the Birmingham Union Railway Company, was effected, together with the placing of the Bessemer dummy lines, under the consolidated management; the total mileage of the above roads aggregating 39 miles; 15 miles horse and 24 miles single track dummy line. It is now proposed to operate the entire system by electricity.

* * A new electric light franchise, running for 20 years, has been granted by the City Council of Elgin, Ill., to I. C. Towner, who will organize a company composed largely of local men, with a capital stock of $100,000. Mr. Towner owns the buildings in which the plant now operated by the Elgin City Railway Company is located. He claims that the company will be furnishing light and power before snow flies, and that both will be much cheapened by the advent of his company.

* * A charter has been granted the Wheless Electric Railway Company, at Alexandria, Va. The capital stock of the company is fixed at $1,750,000. It can hold 500 acres of real estate, and its chief office is in Alexandria, with John L. Beach as its agent. The officers of the company for the first year are: Samuel E. Wheatley, president; Henry M. Baker, vice-president; Daniel F. Mevill, secretary; George T. Dunlop, treasurer, and the above, with Malone Wheless, Maurice J. Adler, Clement W. Howard, R. W. Darby and William Wheatley, are its directors. The corporators are all Washington men.

* * Denver, St. Louis and Pennsylvania capitalists have been collecting statistics covering the passenger traffic between Junction City and Ft. Riley, Kansas, the probable appropriations for the fort during the coming year, the growth and the resources of the city, and future outlook, with a view of building an electric street railway line between the city and the fort. A careful estimate shows that after the work begins at the fort this summer, not less than 30,000 trips per month will be made between the two places, besides a great amount of other business which would be done by an electric line. This is a great opening for men with capital, and they are begining to appreciate that fact.

A Self-Binding Cleat.

With the growing demand for improvement in electrical construction, new devices are constantly being placed on the market. The latest thing presented is a self-binding wood cleat, which is fully illustrated in the cuts.

Fig. 1 shows the cleat before it is placed upon the wires; the strap is turned aside and the lugs moved out of the way, so as to

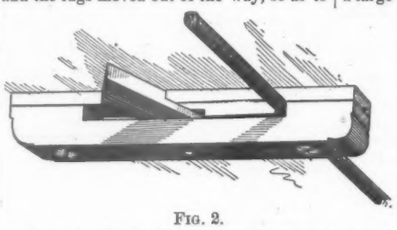


Fig. 2.

receive the wires. When these latter are placed in position, the strap is moved back so that its screw holes are directly over those in the lower portion. The cleats are then screwed in place, and when the wires are drawn taut, the lugs are pressed against them, holding the wires firmly. A number of these cleats can be put up, and the wires

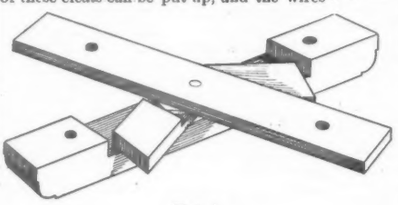


Fig. 1.

tightened afterward with great facility, each cleat being, in fact, an anchor. The same cleat will take any size of wire from No. 10 to No. 18. These cleats are handled by the Central Electric Company, of Chicago.

The Law of the Street is "Move on."

For the traveling public, as we have already seen, the law of the street is motion; a law not more strictly enforced by the London policeman ordering Jo to "move on," than it was in New York when an enterprising dealer blocked the way by exhibiting to curious crowds seven sisters in his showwindow, combing their wonderful hair. The court considered such an exhibition highly sensational and condemned it and the consequent obstruction as a public nuisance. It was abated, and the public procession resumed its movement.

But it is not encroachments only that embarrass public travel. The opposite courses and cross currents of travel itself cause inconvenience, and have led to a variety of rules of precedence and passage, which, taken together, constitute our "law of the road." This law of the road is somewhat complex and uncertain, being still in the formative period. Pedestrians meeting each other may pass to the right or left, according to their whim. So may riders on horseback. So may vehicles proceeding along streets crossing at right angles, or passing each other in the same direction. In all four cases each is bound to exercise due care not to injure the other. But vehicles moving in opposite directions must pass each other to the right. One attempting to pass or to keep to the left, even though in a loaded wagon meeting a light one, takes the risk of possible injury without chance of redress; but his offence would not justify his adversary in wilfully running him down.

For many years it was sought to establish that in the public streets, as on the highway of the sea, the stronger must give way to the weaker; that vehicles should yield to the pedestrian; but the struggle was in vain, and it is now settled that drivers and walkers must maintain mutual watchfulness and look out for each other. If, however, the driver goes at a reckless rate, especially if, as is irritatingly common, he dashes over a cross-walk, he is liable to a strict accountability at the complaint of any injured foot passenger.—*From "The Rights of the Citizen as a User of the Public Streets," by Francis Lynde Stetson, in May Scribner.*

On and after May 11, 1890, the celebrated Congressional limited express, of the Pennsylvania Railroad, will make the run to Washington in five hours and five minutes. This surpasses any time ever made on a regular schedule. The train will leave stations foot of Desbrosses and Cortlandt streets at 3.20 P. M. daily, arriving at Baltimore 7.28, and at Washington 8.25 P. M. A superb equipment of Pullman vestibule, parlor and smoking cars, and a Pennsylvania Railroad dining car, will afford luxurious accommodations.

GENERAL NOTES.

The Edison Electric Illuminating Company is paying a dividend of $2 per share.—New Bedford, Mass. *Mercury.*

During the week ending April 12, 50 volumes were added to the Brooklyn Institute Free Library, the collection containing a large number of valuable works on electricity.

The manufacturers' committee of the exhibition to be held in St. John, N. B., during the coming season, informs us that the committee will be pleased to furnish space and power free of charge, and to offer every facility for the display of electrical apparatus of all classes.

Supt. M. J. Carney, of the Central Union Telephone Company, was in Fostoria, Ohio, recently, looking up the telephone interest and reconstructing the local exchange. Estimates have been sent in to headquarters for the cost of constructing a line to Lima, Findlay, North Baltimore, Carey and Upper Sandusky, to connect with Fostoria, and also the cost of a copper line from there to Toledo.

Five times since its establishment, in 1882, has the Ball Electric Light Company found it necessary to enlarge its premises, says the Toronto *Electrical News.* During the last month the offices and factory have been removed from 67 Adelaide street, west, to Nos. 70, 72, 74 and 76 Pearl street, Toronto. The new factory will afford the company four times the amount of floor space which it has hitherto had at its disposal. A quantity of new tools have been added; also a moulding shop, where in future all castings entering into the company's manufactures will be made.

The Wenstrom Company's Business Plan.

The new factory of the Wenstrom Consolidated Dynamo and Motor Company, Baltimore, will be located at Calverton Heights, which has excellent railroad and shipping facilities. This company will again put in motion the wheels of industry, whose busy hum was heard in this locality over 200 years ago, and add to Baltimore another important productive corporation.

The engagement of Mr. H. F. Parshall, formerly with the Sprague Motor Company, is a most excellent one for both parties, as Mr. Parshall will now have a clear field to put into practice his advanced ideas in electrical work. Chadbourne, Hazelton & Company, Philadelphia, are sole agents. An agency of this kind is a new feature in electrical work, although the plan is adopted by the manufacturing corporations of our country. It relieves the manufacturer of the employment of a large amount of extra capital, and the agent is at liberty to buy his lamps, wire, etc., wherever he may elect.

It will parallel the custom of the steam engine agent representing one builder, but buying or making boilers, pumps, heaters, pipes, etc., as he pleases.

The largest order for steam engines ever given was by Mr. Edison to the Armington & Sims' Engine Company, Providence, R. I., some years ago. The Wenstrom Company has followed his example and placed their order with the Armington & Sims Engine Company for 40 of their standard engines of various sizes.

The Wenstrom Company starts under the most auspicious circumstances in every respect, and bids fair to become the most important competitor that has yet aspired for electrical supremacy.

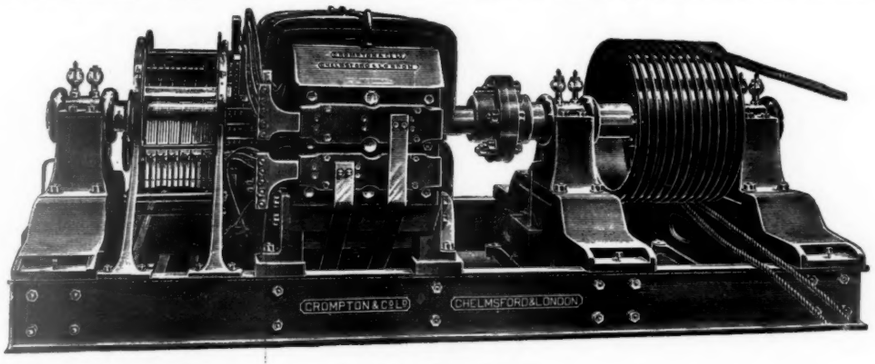
The Venezuela Telephone Company.

The American Electric and Manufacturing Company, organized under the laws of Virginia, capital stock, $200,000 preferred, and $500,000 common, is the successor of the American Telephone Company, and has purchased all its property and business, which consists principally of telephone lines and electric light plants in Venezuela. The executive office of the company is in Washington, D. C., and its business office is in Caracas. The officers are ex-Senator D. M. Sabin, president; James L. Barbour, vice-president; Horatio Browning, treasurer, and Fred. G. Norris, secretary.

Four-Pole Drum Dynamo.

We illustrate a new four-pole drum machine made by Messrs. Crompton & Company, Limited, electrical engineers, Chelmsford, Eng. We are indebted to our contemporary, *Industries*, for the following description, that journal stating that it feels confident that the single magnet two-pole drum dynamo now in almost universal use will give way to the four-pole type for sizes above 200 watts per revolution, and that the four-pole machine seems to have everything in its favor. The end couplings, which are the most troublesome part of two-pole machines, are beautifully simple when four poles are used, as the connections are only a quarter round the armature, and do not tend to foul the spindle or to block up ventilation spaces. Besides this, they are infinitely more accessible, a point of great importance with reference to repairs. If a four pole machine has the same number of active conductors, the loss by hysteresis in the armature is approximately the same as in a two-pole machine, for, though the iron is reversed twice as often, there is only about half the volume; or if, on the other hand, the radial depth is kept as before, the induction is very much lower. For large currents the four-pole drum is especially suitable, as the current in each conductor is one-fourth of the whole current, and the commutator sections are more numerous than in the corresponding two-pole machine.

The machine has an output of 50 volts and 2,500 amperes at 400 revolutions per minute. The armature has 48 external conductors of 185 strands of No. 16 B. W. G., twisted and compressed into a rectangular cross section. The armature diameter is 22 inches. It is built of disks, keyed to a soft steel spindle. The spindle is made in two parts, coupled by a cast iron coupling, and fitted with a pulley for rope driving. There



NEW FOUR-POLE DYNAMO.

are three bearings, and these have only the bottom brasses lined with white metal. The magnets are wound with 13 layers of copper strip 0.19 inch by 0.24 inch, resistance cold, 0.9 ohm, all in series. The magnets are 26 inch by 11½ inch. There are four sets, of six brushes each. The opposite brushes are coupled together in parallel. Each brush is two inches wide. The machine is mounted on a bed-plate built up of two channel girders of wrought iron, to which the pedestals of the magnets and the bearings are bolted.

One of the chief advances in this machine is the engineering design of the armature conductors. These have faced joints and are screwed together with steel bolts and nuts. So perfect is this system, and so simple are the end connections, that the whole armature can be stripped in four hours, and put together in a somewhat longer time, including new bands. A repair, if ever necessary, could be executed in a very short time, unless, of course, the bands had to be taken off. This dynamo is for smelting work, a branch of electric business in which, as is well known, Messrs. Crompton have been particularly successful.

—— Mayor Chapin sent the petition of the Brooklyn Electric Light and Power Company for a franchise to the Board of Aldermen. It was at once referred to the Lamps and Gas Committee, where scores of petitions from this same company lie buried.

—— It will not be long before from the cliffs of the island of Vancouver the electric light will shed its brilliant glare upon the shimmering surface of the Pacific ocean. According to intelligence received a few days ago, an electric light company has been organized at Vancouver, B. C., for the purpose of lighting up the city. The Westinghouse alternate current apparatus for central station plants has been contracted for by the Vancouver company.

Metropolitan Museum of Art Now Lighted by Electricity.

A new departure of great interest to the public of New York, has been inaugurated at the Metropolitan Museum of Art, New York city. Preparations have been completed for lighting the entire building by electricity. The great halls and galleries are now flooded with light from 3,000 incandescent lamps, fed from four dynamos in the basement.

The museum will hereafter be open to the public every Monday and Thursday evening in addition to the accustomed four free days.

Canadian Tariff on Electrical Goods.

The revised Canadian Tariff upon electrical apparatus is as follows: Telephone and telegraph instruments, telegraph, telephone and electric light cables, electric and galvanic batteries, electric motors and apparatus for electric lights, including incandescent light globes and insulators of all kinds, N. E. S., 25 per cent. *ad valorem;* lamp, gas light and electric light shades, lamps and lamp chimneys, side-lights and head-lights, globes for lanterns, lamps, electric lights and gas lights, N. E. S., 30 per cent. *ad valorem;* electric arc light carbons or carbon points, $2.50 per 1,000.

Gas.

On May 5th the following casualties from illuminating gas were reported:

An eight year old child was found dead in bed at the side of its nurse, who was unconscious. The unlighted gas had been left turned on in the room.

A woman entered her kitchen in a tenement house, on Clinton street, lit the gas and was thrown to the floor in an unconscious condition. The room was filled with escaping gas which exploded when the light was struck. The explosion was of sufficient force to injure another woman in an adjoining room, besides doing considerable damage to the room.

Another woman, knowing the deadly effects of illuminating gas, and wishing to commit suicide, lay down on a sofa in her parlor and inhaled the gas by holding in her mouth the rubber tubing from a drop-light. She succeeded in her attempt to kill herself.

—— The lowest bidder for the contract for lighting the streets of Asheville, N. C., was L. H. Cox, of Washington, D. C.

—— Mount Morris, N. Y., is not a very big town, but the people who dwell in it are to have the advantages of electric lighting, nevertheless. An order was recently placed with the Westinghouse Electric Company for a 500-light outfit for Mount Morris, and no time will be lost in the installation of the apparatus.

—— The Public Building Commissioners, of Philadelphia, received a report from the architect relative to lighting the new building with electric lights. He reported that the cost of a plant of the Westinghouse system would be $8,639, and that the cost of the commission for maintaining a sufficient number of lights for the building would not exceed $10,000 per annum. The report was received and its recommendations adopted. Mr. Chas. A. Bragg is the Philadelphia representative of the Westinghouse Company.

Annual Meeting of the Westinghouse Company.

The annual meeting of the above company was held in Pittsburgh, last week. Mr. Westinghouse stated to a reporter that a "joint meeting will be held in a short time, when the transfer of the Westinghouse Electric Company will be made to the Westinghouse Electric and Manufacturing Company, and at which a statement will be made. This meeting will be called in a few days."

The following were elected directors for the Westinghouse Electric Company: George Westinghouse, Jr., Henry M. Byllesby, Robert Pitcairn, John Caldwell, J. R. McGinley, Calvin Wells, Charles S. Pease.

The following were elected for the Westinghouse Electric and Manufacturing Company: President, George Westinghouse, Jr.; directors, Henry M. Byllesby, Robert Pitcairn, C. H. Jackson, G. W. Hebard, J. R. McGinley, Calvin Wells, H. R. Garden, A. M. Byers.

—— The Lowell, Mass., Electric Light Corporation has just placed in position a new and larged-sized generator to furnish power exclusively for the electric railway to Willow Dale. During the past week a new 200 horse-power Armington & Sims engine was put in to run the generator.

—— The annual report of the Moorestown, N. J., Electric Light Company, will show gratifying results, the plant being, it is stated, on a paying basis after four months' operation. The entire cost of the plant was about $28,000, with a capacity of 1,500 lights, about 900 of which are already taken.

—— The electric light is constantly growing in popularity in the city of Elmira, N. Y. The Illuminating Company of that place, which commenced operations less than a year ago, has since that time been obliged to twice increase its capacity, owing to the great demand made upon the light. The Westinghouse Electric Company, whose system of alternating current apparatus has been in use there from the first, received the third contract from the Elmira Illuminating Company a few days ago, and the company has now a capacity of 2,250 lights.

—— The Corning, N. Y., Gas Company made a proposition to the council to furnish not less than 50 arc lights and have them burn all night and every night, for $100 per year for each light. The board decided to accept the proposition, and will enter into a contract at once with the above company for five years. The company agree to deposit a sufficient amount to show their good faith and will agree to have the plant ready for operation by July 1, of this year. The Mayor appointed Aldermen Fedder, Peart and Clisdell, to supervise the work of putting in the plant.

—— The plan of the St. Louis Broadway merchants for a special electrical illumination of that thoroughfare, from Franklin avenue to Elm street, has not fallen through. A contract to this end was closed several months ago with the Municipal Company, of which Mr. Charles Sutter is vice-president, but the company has been so busy with its preparations for lighting the city, that the special illumination of Broadway was necessarily postponed. Mr. Sutter said last week that steps would be taken at once to carry out the original plan, which would be perfected within a few weeks.

ELECTRIC LIGHT NEWS

—— L. M. Sawyer, an electric light man of Hampton, Va., was drowned May 1st.

—— The electric light station at Windsor Locks, Conn., is to be increased from 500 to 1,000 lights (incandescent) capacity.

—— The business men of Flint village, near Fall River, Mass., are pressing their selectmen to furnish the community with electric lights.

—— The East St. Louis Electric Light & Power Company have furnished their new station and are rapidly supplying consumers with incandescent lights.

—— The Fort Wayne Electric Company is said to be arranging for the establishment of an incandescent light plant in St. Thomas, in opposition to the St. Thomas Gas and Electric Light Company.

—— The Thomson-Houston Electric Company presented the Second Regiment, of Chicago, a receipted bill for refitting the electric plant of the armory on Michigan avenue, a donation of $248.83.

—— The Electric Light Company, Worcester, Mass., has offered to furnish light to Worcester as follows: For one year, 55 cents per light; for three years, 50 cents; for five years, 45 cents.

—— Westinghouse alternating current apparatus, for central station plants, of a capacity of 500 incandescent lights, has been contracted for by a company which has been organized at Windsor Locks, Conn.

—— The gas company and the electric light company, of Trinidad, Col., have pooled. At a meeting of the directors, Hon. F. D. Wight was elected president. Mr. Wight is president of the electric light company.

—— The Brooklyn Edison Electric Illuminating Company, through H. A. Pitcher, has made a contract with the Postmaster-General to light the Brooklyn Post Office. The new lights were to be turned on May 15th.

—— One of the humorous things connected with the electric light campaign in Middlebury, Vt., is that a resident of that hamlet has applied for the position of lamplighter when the new light shall have been turned on!

—— Cohassett, Mass., is to be illuminated by electricity, and a central station will be erected at once near the Old Colony depot. The beautiful marine drive known as Jerusalem Road, will be extended and lighted throughout its entire length.

—— From the judiciary committee of the Senate on April 30th, was reported and passed the act authorizing the city of Providence, R. I., to cause electric wires to be placed underground, and the same was referred to committee on engrossed acts.

—— Along with the other improvements which the Pennsylvania Railroad Company has inaugurated at Altoona, Pa., is to be added an arc light plant of 90 lights. The company will use the new Westinghouse arc light system and the machinery will be immediately installed.

—— The Municipal Electric Light and Power Company, St. Louis, which is a consolidation of the late electric light interests in St. Louis, started its new plant on Friday evening, May 2d, furnishing to the city 3,000 arc lights. The plant is located at 18th and Gratiot street. The above company is also furnishing incandescent lights.

—— The city council, of Spartanburg, S. C., has awarded the contract for lighting the city. The city has contracted for 50 arc lights at $80 per annum, to burn all night and every night, except three nights before and after every full moon. The Schuyler system of arc lighting will be used.

—— The Rutland, Vt., Electric Light Company, M. J. Francisco, president, has been awarded the contract for lighting the streets of that city for the remaining months of the fiscal year, to March 1, 1891. President Francisco offers $100 reward for evidence that will secure the conviction of the person who opened the boiler doors at his station. The boiler at the time, was under a pressure of 95 pounds; and, as a result, in less than two minutes, the pressure went down to 60 pounds necessitating shutting off the "outside circuit" for about 15 minutes, until the steam pressure could be restored.

KINDRED INTERESTS

The Hendey Machine Company, Torrington, Conn., is enlarging its factory and increasing its manufacturing facilities.

The Southern Electrical Supply Company have closed a contract to furnish the Pittsburg Electric Light Company, Pittsburg, Kan., 20 miles of Candee weather proof wire.

The Mitchell Vance Company has issued Catalogue No. 3 of their combination and electric light fixtures. It is a large volume of folio size, handsomely bound, and contains 40 lithographed plates. The designs illustrated are novel and beautiful. The Mitchell Vance Company deserves credit, both for the tasteful designs and the handsome catalogue.

Mr. Geo. W. La Rue, of P. A. Dowd & Company, has closed a contract with the Rapid Transit Street Railway Company, of Newark, N. J., for the electrical equipment of their entire line with the new Sprague electric apparatus, the road to be in operation by July 15th. This will be one of the finest electric railways in this country, and one of the most important.

The Westinghouse Electric Company is highly elated at the reception its Shallenberger meter is receiving at the hands of the central station companies using the Westinghouse alternate current system. Ever since the meter was placed on the market its sale has been going steadily along. During the month of April, meters to the capacity of almost 50,000 lights were sold.

The Eclipse Wind Engine Company, Beloit, Wis., is furnishing the Queen City Electric Light and Power Company, Dallas, Texas, shafting, clutches, pulleys and couplings, stands and other appliances for the transmission of power, sufficient to double its present capacity. This company has recently increased the capacity of its works and yet is obliged to "keep moving night and day" to meet the demand for its specialties.

The Burton Electric Company, of Richmond, Va., are in receipt of a very complimentary letter from the president of the St. Louis Electric Railway Company in regard to the Burton electric heaters. The following passage occurs: "We are using your heaters on our cars, and must say that they give us good satisfaction. We are much pleased with them, and know of no reason why we shall not continue to use them and recommend them to others."

The St. Louis Electrical Supply Company was recently incorporated under the laws of the State of Missouri, with a capital stock of $25,000. The object of the company is to carry a general line of electrical supplies. The following gentlemen are the incorporators: H. C. Scott, W. Z. Scott, J. F. Porter and G. W. Brink. The company have purchased the stock of the Electrical Supply Company, at 403 North Eighth street, and will, after increasing the stock, do business from the old stand.

The Rochester Street Railway Company, Rochester, N. Y., have just closed a contract with the Ball Engine Company, of Erie, Pa., for three 300 horse-power triple expansion engines; three 135 horse-power standard engines; one 60 horse-power standard engine, making a power station of 1,335 horse-power in all. The Ball Engine Company are also to furnish everything except the boilers, which are to be of the Heine type. This electric power station is expected to be one of the most perfect stations ever built.

The Thomson-Houston Electric Company report the following sales for the past week: Geo. Meritt & Son, Woolen Mill Company, 100 incandescent lights for their woolen mill, at Indianapolis, Ind. C. C. Travis, Tecumseh, Mich., fifty, 1,200 candle-power arc, and 650 sixteen candle-power alternating current incandescents. Aurora Electric Light and Power Company, Aurora, Ill., thirty-five 2,000 candle-power arc lights. Camden Electric Light and Power Company, Camden, Ark., 650 alternating incandescents.

Standard Underground Cable Company.—This company celebrated the removal of its New York branch into new offices, in the *Times* building, on May 7, by making the successful bid on the new Fire Department specifications for 1890. Bids were opened on that date. The bid of the Standard Underground Cable Company was $47,771.59, and was the lowest. Six hundred and fifty thousand feet of conductor, in standard lead covered cables, and 30,000 feet of two-inch pipe are to be furnished and laid.

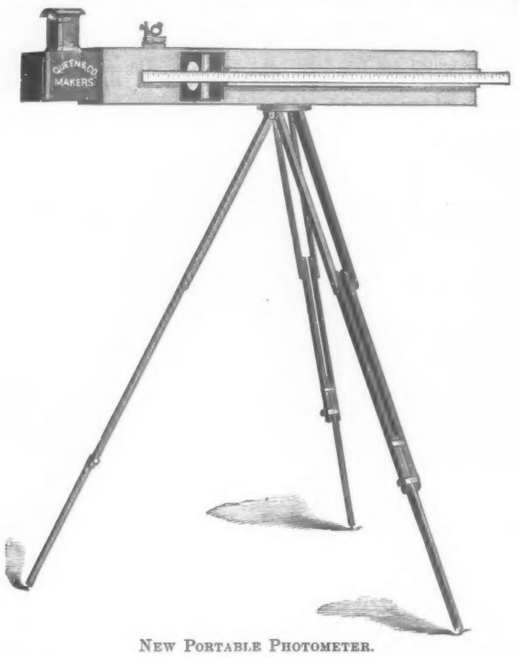
The Buckeye Engine Company, Salem, Ohio, report their business for the last four months as unprecedented, having booked a larger number of orders in that time than ever before in the same period, since the organization of the company, over twenty years ago. The number of orders now in their hands is beyond the present capacity of the plant, and the works are being rapidly extended to meet their constantly increasing business. During the time mentioned, orders have been received for engines to be placed in every state and territory, besides one to Moscow, Russia, three to the Republic of Mexico, and six to Japan. Two of the latter are to be placed in the largest hotel in Yokohama.

The Gethins Electrical Manufacturing Company, of Boston, were gratified to learn that Electrician Henry A. Chase had reported to the Boston board of police commissioners "that the Gethins gravity batteries placed in station 10, January 17, 1889, were recharged with new elements of the same kind April 4, 1890, having shown a constant service of 14 months 18 days. As the service of a battery is in proportion to the work done, I would state that during that time there were received 2,357 wagon signals; 12,237 telephone signals, and 198,486 'on duty' signals. As each signal will average 10 breaks of the current, this would indicate an armature movement of 2,131,160 times. As compared with the standard Crow Foot battery, the best record in this service is seven months 23 days."

The Three Links Railway.—Travelers on business or bent on pleasure, invariably visit one of the great cities of the West, if their journey is at all prolonged. Nowhere else can be seen such centers of enterprise and American vim as in Chicago or Kansas City, and few invite lovers of elegance and beauty like St. Louis. Starting from Chicago, the great starting point of Western travel, no line can be found more desirable than the Chicago & Alton, the great "Three Link" route, and its unsurpassed connections. Elegant cars, courteous train men, a first-class track, and every convenience that modern railroading employs, is here found for safety and comfort. The country traversed is unexcelled for beauty of scenery—the veritable garden of the continent. If you secure tickets of the Chicago & Alton you will have a pleasant journey.

New Portable Photometer.

Queen & Company, of Philadelphia, electrical instrument manufacturers, have recently brought out a new form of Bunsen Photometer. The instrument as made by them is designed especially for street work and will be found valuable to municipal and government inspectors and experts having occasion to make candle power tests of arc and incandescent lamps. The Photometer is well made and exceedingly compact. It is 5¼ inches square in cross section and 38 inches in length and made of polished cherry. The lantern, as shown in the cut, slips into one end of the box where it is firmly held; a small adjustable holder carries the standard light, which may be either one or two standard candles; this adjustment regulates the height at which the flame stands and also its distance from the screen; by making this latter distance exactly one foot, computation is greatly facilitated. Distances are measured by a graduated bar which slides in grooves along the side of the box. To allow for the difference in vision between the right and the left eye, the instrument is made reversible, *i. e.*, it may be turned completely over so that the right eye observes the side of the disk before observed by the left and *vice versa*.



NEW PORTABLE PHOTOMETER.

When not in use, the lantern chimney slips out and can be placed inside the lantern itself, after which the entire lantern box may be pushed inside the photometer and small slides made to cover the two ends and the sight hole of the instrument, making a solid box of it; a brass handle on one side allows the instrument to be carried as easily as a small hand bag. If desirable, a small incandescent lamp may be used as a standard instead of the candles. The range of the instrument is from about four candle-power up. It has already been very successfully used in several tests.

A Chance to Write about "Currents."

Three cash prizes of $50, $30 and $20, respectively, are offered by *Public Opinion*, the eclectic weekly magazine, of Washington, D. C., for the three best essays, not exceeding 2,000 words, on the subject: "The Study of Current Topics as a Feature of School, Academic and College Education." The papers must reach *Public Opinion* prior to June 15, and the award will be made by a committee of three well-known educators, to be selected and announced before the close of the competition. The prize essays will be published over the signatures of the writers, July 5. Particulars of the contest may be had by addressing the editor of *Public Opinion*.

Annual Meeting of the Metropolitan Telephone and Telegraph Company.

The annual meeting of the above telephone company was held in the "Telephone" building, New York city, Thursday of last week. The election of directors and officers resulted as follows: President, Chas. F. Cutler; treasurer, W. R. Driver; acting general manager, David B. Parker; general superintendent, E. W. Carritt; directors, Dr. Norvin Green, Gen. T. T. Eckert, John Van Horne, Geo. Gould, Chas. A. Tinker, W. H. Forbes, John E. Hudson, Theo. N. Vail, Edward J. Hall, Jr., W. H. Wolverton, L. F. Beckwith, Jos. P. Davis, Chas. A. Cutler; executive committee, Chas. F. Cutler, Gen. T. T. Eckert, John Van Horne, Edward J. Hall, Jr., L. F. Beckwith, Jos. P. Davis.

Col. W. H. Eckert, who has been general manager of this company, had resigned previous to the annual meeting, and Col. David B. Parker, a well-known and experienced telephone man, elected to fill the vacancy. The position of general superintendent has been vacant since the resignation of Mr. W. A. Vail, who has moved to Boston.

American Institute of Electrical Engineers.

The annual meeting of the above Institute for the election of officers for the ensuing year and the transaction of other business, will be held at the house of the American Society of Civil Engineers, 127 East Twenty-third street, New York City, Tuesday evening, May 20th.

After the conclusion of the regular business of the annual meeting the following paper will be read: "Electricity in the Navy," by Mr. Gilbert Wilkes, late of the United States Navy.

Upon the adjournment of the meeting the evening of May 20th, those who intend taking part in the general meeting at Boston, May 21st, will reassemble at the Grand Central Depot, Forty-second street, in time for the Shore Line train for Boston at midnight.

The general meeting for the reading and discussion of professional papers will be held at the "new building" of the Massachusetts Institute of Technology, corner of Boylston and Clarendon streets, Boston, Mass., May 21st.

The morning session on Wednesday will be called to order at 10 o'clock.

The proceedings will be opened with an address of welcome by Gen. Francis A. Walker, Ph.D., LL.D., president of the Massachusetts Institute of Technology.

After a response by the president, the following papers will be read:

"Electric Lighting in the Tropics," by Wilfrid H. Fleming, of New York City.

"Magnetic Data of the Sprague Street Car Motor," by H. F. Parshall, of New York City.

"Note on a New Photometer," by Dr. Edward L. Nichols, of Ithaca, N. Y.

"The Limitations of Steam and Electric Transportation," by Oscar T. Crosby, of New York City.

"The Industrial Utilization of the Counter Electro-Motive Force of Self Induction," by Thomas D. Lockwood, of Boston.

"A Study of Arc Light Carbons," by Louis B. Marks, of Cornell University.

"The Practical Aspects of Alternating Current Theory," by Dr. Michael I. Pupin, of New York.

"Automatic Electric Welding Machines" (with Experimental Demonstrations), by Hermann Lemp, Jr., of Lynn, Mass.

Miscellaneous business.

The members of the Institute will be the guests of the Boston Electric Club at a dinner, the hour and place of which will be announced on Wednesday. A paper will be read, under the auspices of the Club, by Stephen E. Barton, of Boston, on "Central Station Insurance."

The headquarters of the Club are at 7 Park street, where members will be welcome during their visit to the city.

A cordial invitation is extended to all persons interested in electrical progress, to attend the sessions of the general meeting, and New England members are especially requested to call the attention of their friends to this fact.

The thoroughly equipped electrical and engineering laboratories of the Institute of Technology will be thrown open for the inspection of all.

ELECTRIC CLUBS.

MEETINGS OF BOSTON AND KANSAS CITY CLUBS.—OTHER NEWS.

New York Electric Club.

Among Recent Visitors to the Club were W. T. Beidler, of Baltimore, Md.; M. E. Baird, of Windsor, Conn.; H. D. Stanley, Bridgeport, Conn.; Mr. Von Köhler, Stockholm, Sweden; Geo. E. Voorhees, Jr., Morristown, N. J.

The Spring Cleaning which the Club house has received, makes a noticeable improvement in its appearance, both inside and out, and no more comfortable and pleasing Club is to be found in the city.

The First Meeting of the board of managers, of the fiscal year, was held Thursday evening of last week, and a good deal of routine business was transacted, but owing to the absence of the president, the appointment of new committees for the year was postponed until the next meeting.

Boston Electric Club.

Messrs. English & Orford, of the New England Electrical Supply Company, Bridgeport, Conn., were guests of the Club, during their short visit to the city recently.

Mr. Geo. W. Mansfield's paper on "Single and Double Trolleys for Electric Roads," before the members of the Club, on Monday evening, April 28th, was both interesting and instructive, and heartily enjoyed by a large and appreciative audience. In another column the paper alluded to is published in full.

Tribute of Respect.—Recently the Club rooms were adorned with a large variety of fragrant flowers and lovely vines, most noticeable among which was a vine artistically entwined around the portrait of Mr. Frank Ridlon, the first president of the Boston Electric Club. The decoration was placed there as a token of respect and esteem of every member to the "father" of the Club.

The Regular Monthly Dinner of the Club, which was announced to take place Monday, May 19th, has been postponed until the evening of Wednesday, May 21st. The president of the Club—through the president of the American Institute of Electrical Engineers—has sent an invitation to the members of that society to attend the dinner alluded to, on the evening of the day the society named holds its convention in this city.

Mr. Arthur B. Griggs, the irrepressible disciple of theosophy, has returned from a short visit to the site of the World's Fair. While in the West, Mr. Griggs stored away in his mental accumulator an almost inexhaustible fund of interesting anecdotes and mirth-provoking narratives, thus enabling him to furnish a "continuous current" of good humor whenever he attends a "Crank's" dinner or any other social gathering.

The advantage of single trolley over double trolley wires, was the subject discussed at the Club rooms, on the evening of April 28th. G. W. Mansfield's paper opened the debate, and was mainly confined to a presentation of the commercial side of the question. The difficulties under which the system of double trolley wires would work in stormy weather, and the crowded streets of a large city, to say nothing of the expense, were, in the opinion of the speaker, insuperable objections to a complete metallic circuit for electric railways. W. J. Denver, of telephone fame, was the only speaker in opposition. His remarks were brief, and aimed to determine the responsibility as between the telephone and railway companies, for the added outlay in the more elaborate construction. L. S. Dumoulin, electrician for the West End Street Railway, and F. M. Gilley, made brief remarks.

It is said that among the prospective applications for active members to be handed in this month, are President Whitney and several other officers of the West End Electric Railway Company.

The Regular Monthly Meeting of the Club was held in the Assembly room, on Monday evening, May 5. Seven applications for membership were acted upon, and the respective applicants were unanimously elected.

Amendments to the Constitution and By-Laws, proposed at the previous monthly meeting, were discussed, and with but few alterations and amendments, unanimously passed.

Other Notes.

The Kansas City Electrical Society held an interesting meeting, April 23d, in the secretary's office of the Missouri and Kansas Telephone Company. A complete reorganization was effected, the following officers being elected: President, Wiley W. Smith; vice-president, J. H. Aldrich; second vice-president, Thomas F. Clohesey; secretary, A. M. Barron; treasurer, George W. Johnson; additional members of the executive committee, H. W. Ritterhoff, Paul W. Bossart, E. Monahan, W. C. Moore. Monthly dues were raised to 50 cents. The initiation fee remains $2, as heretofore. Meetings will be held regularly hereafter Friday evening of each week, in the telephone company's general office.

Edwin S. Hewson, an electrician of the Westinghouse Electric Company, and member of the Chicago Electric Club, died of pneumonia, at his home, 236 LaSalle avenue, Saturday evening, April 19th. Mr. Hewson was born in Newark, N. J. He was the second son of Commissioner Theodore C. Hewson, and grandson of the late Judge Hewson, of Newark, N. J.

Wire Peeler.

Those who have handled annunciator and office cotton covered wire will appreciate the value of a device through the use of which insulation can be removed quickly

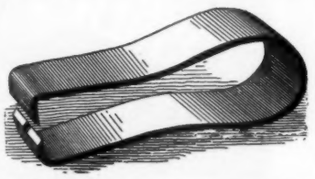


FIG. 1.—SCRAPER FOR INSULATED WIRE.

and with less trouble than when a pen-knife is employed.

The cuts presented herewith illustrate a little tool which works most satisfactorily as a wire peeler. Besides being useful for removing the insulation, it works most effectively as a wire cutter. In order to cut the wire, the tool is applied as shown in

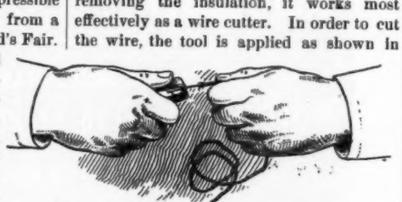


FIG. 2.—THE METHOD OF HOLDING.

Fig. 2, and given a quick jerk up and down. By this action the wire is notched and can be readily broken off.

A man can remove the insulation from the ends of wire with this tool in one-tenth of the time required with a knife or pair of pliers, and the work is cleaner and neater. The tool is the invention of Mr. F. L. Perry, and is handled by the Central Electric Company, of Chicago.

Current Pie.

Quoth the waiter,
"What is yours, sir?"
Said the guest,
"I'll have a pie."
Returned the waiter bye and bye;
"Custard, lemon, apple, pumpkin,
Peach or mince, sir, will you try?"
Guest, facetious:—
"Give me currant,
Alternating current pie."
Vanished waiter hurriedlye;
Soon returned he with the currant—
Alternating currant pie.
First a currant,
Then a fly,
'Neath the crust alternate lie.
Perished waiter
Horriblye.—*Life.*

An Important Decision Relating to Electric Gas Lighters.

The strength and validity of the well-known Packard, Sanford & Tirrell, patents for improvements in electric hand-lighting gas burners, and which are now conjointly owned by The Electric Gas Lighting Company, of Boston, and A. L. Bogart, of New York, have just been reaffirmed by Judge Colt, of the U. S. Circuit Court, District of Massachusetts. A bill for infringement of these patents was entered against Fuller, Holtzer & Company and its successors, the Holtzer-Cabot Electric Company, who set up the plea of no invention in the patents under question, and hence, no infringement on their part. The court decides otherwise, in unmistakable terms.

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TELEPHONES

THE MOST

Efficient, Desirable and Practicable.

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(Mention this Paper.)

The New Metal of the Present, no longer "The Metal of the Future."

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Large Factory Facilities.

THE OWNERS of a large, modern manufacturing establishment in central New York, have business which occupies the plant for a part of the year only. They would be glad to undertake the manufacture of

Electrical Apparatus, Dynamos, MOTORS

Or any Appliances used in Electric Lighting or for Traction Purposes, for parties who may not have sufficient facilities for present orders. Capacity of the foundry, thirty tons of casting per day, which can be increased if desired. Machine shop well equipped with modern machinery and capacity for employing 150 to 200 men.

This factory is exceptionally well located for receiving supplies and for getting low rates of freight both east and west.

Correspondence addressed to "ELECTRIC," care of Editor ELECTRICAL REVIEW, will receive prompt attention.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENTS OF THE UNITED STATES WERE ISSUED ON MAY 6, 1890.

427,039 Method of introducing compositions into electric conductors; David Brooks, Jr., Philadelphia, Pa.
427,042 Electrical train signal; George D. Burton, New Ipswich, N. H.
427,070 Electric dental plugger; William E. Gibbs, New York, N. Y.
427,087 Multiple switchboard for telephone exchanges; Milo G. Kellogg, Chicago, Ill.
427,122 Magneto electric machine. 427,123 Electric loop switch. 427,194 Calling apparatus for metallic circuit telephone exchange systems; Charles E. Scribner, Chicago, Ill.
427,138 Electric connector for brake-horse; William F. Wamsley and Thomas McIntosh, Walla Walla, Wash.
427,154 Divided multiple switchboard. 427,155 Multiple switchboard apparatus. 427,156 Telephone exchange apparatus; John J. Carty, New York, N. Y.
427,163 427,164 Regulator for dynamos; William H. Elkins, Cambridge, Mass.
427,195 Arc lamp attachment; Albert P. Seymour, Syracuse, N. Y.
427,204 Telephone; John C. H. Stut, San Francisco, Cal.
427,206 Apparatus for testing electric lines; Benjamin E. Waters, Brockton, Mass.
427,221 Electric conductor support and protector; Erben M. Boynton, Newbury, Mass.
427,235 Commutator for electric motors; Arnold A. Ingraham, New York, N. Y.
427,237 Automatic electric switch; Mary A. Kissell, Chicago, Ill.
427,259 Electrical collecting device; George Forbes, Westminster, County of Middlesex, England.
427,269 Transmitter for mechanical telephone; Jerome Prince, Milford, Mass.
427,279 Gramophone; Werner Suess, Washington, D. C.
427,294 Dynamo electric machine; De Witt B. Brace, Lincoln, Neb.
427,341 Electric looking attachment; Hermann J. Meyers, Brooklyn, N. Y.
427,361 Power transmitter for railway signals; Joseph Ramsey, Jr., Cincinnati, Ohio.
427,387 Railway signaling apparatus; Henry D. Winton, Wellesley Hills, Mass.
427,429 427,430 Electric signaling system and apparatus for railroads; Charles H. Koyl and Jacob W. Lattig, Easton, Pa.
427,445 Electric conduit; George Sprague, Albion, N. Y.
427,459 Device for unloading, recharging and reloading electric car batteries; Jacob C. Chamberlain, New York, N. Y.
427,468 Electro-galvanic belt; Alonzo Don, Worcester, Mass.
427,503 Electric motor; Louis Duncan, Baltimore, Md.
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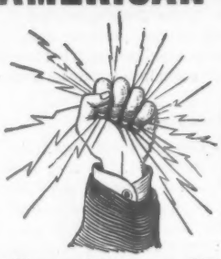

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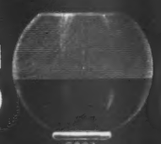
GLOBES  **SHADES**

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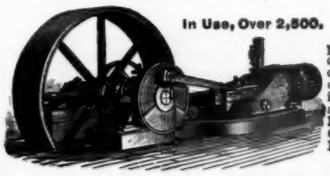

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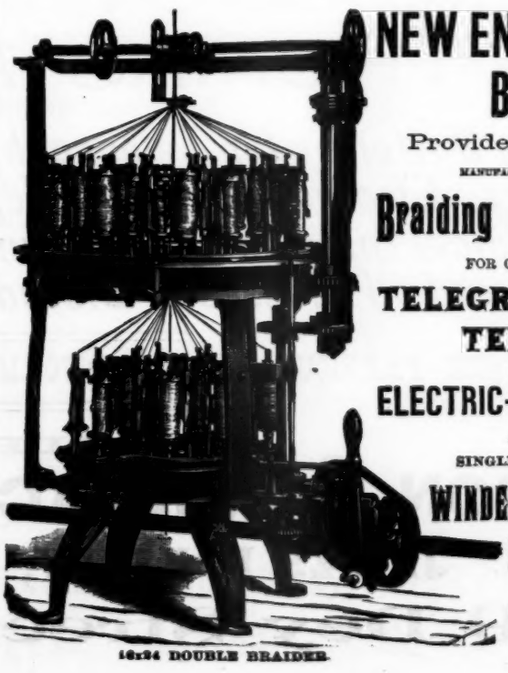

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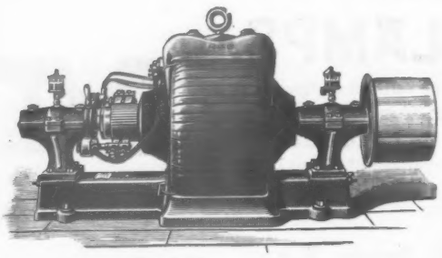

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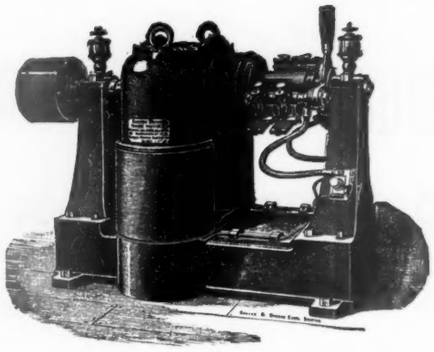

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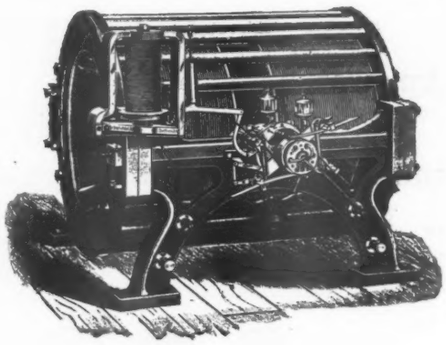

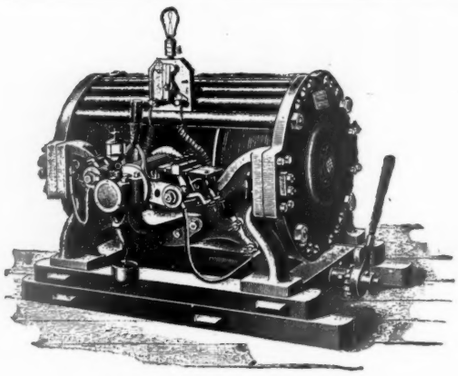

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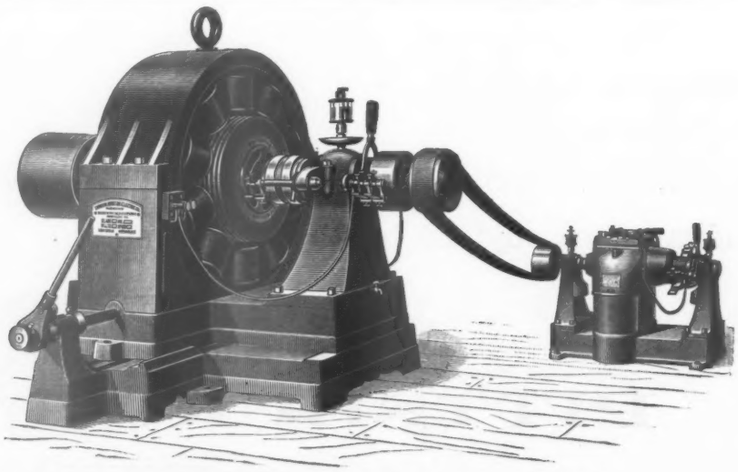

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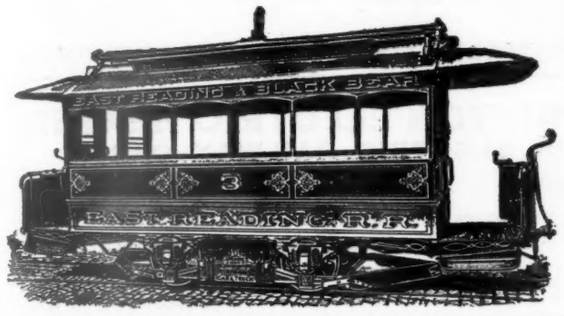

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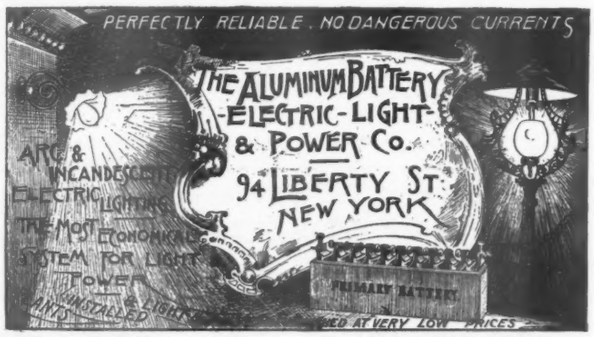

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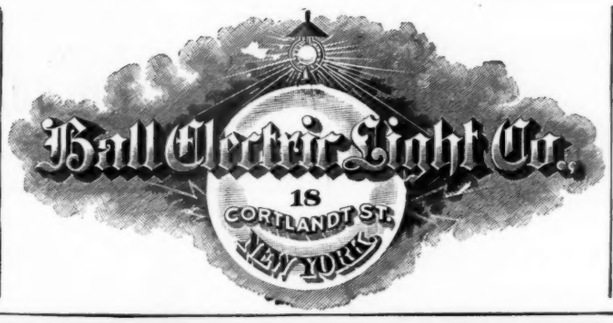
C	8				6.5	1¼	5,000 FEET PER MINUTE.	530
D		10			6.3	1¼		530
E				25	8.0	2		530
F	16				12.0	2½		780
G		20			12.5	2½		780
H			36		13.0	2½		780
I	20				15.0	3		990
J		25			15.6	3		990
K			32		15.0	3		990
L				50	16.0	3		990
M	26				21.0	4½		1,360



LIST OF DYNAMOS IN STOCK.

Designation of Machine.	No. Lights 2,000 c. p. 10 amp. X	No. Lights 1,600 c. p. 8 amp. Y	No. Lights 1,200 c. p. 6 amp. Z	No. Lights 800 c. p. 4 amp.	Horse-Power at Pulley of Dynamo.	Width of Single Belt in inches.	Belt Speed Required.	Weight of Dynamo.
C		35			21.0	4		1,360
D			45	70	21.0	4		1,360
E					21.0	4½		1,360
F	40				29.7	6		1,750
G		50			30.0	6		1,750
H			64		29.5	6		1,750
I	52				38.0	8		2,290
J		65			38.6	8		2,290
K			83		38.0	8		2,290
L	64				46.5	10		2,770
M		80			47.1	10		2,770
N	75				52.5	12		3,200

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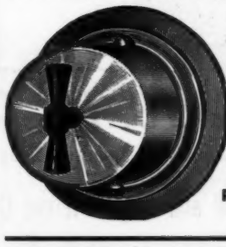

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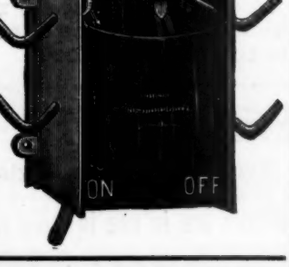

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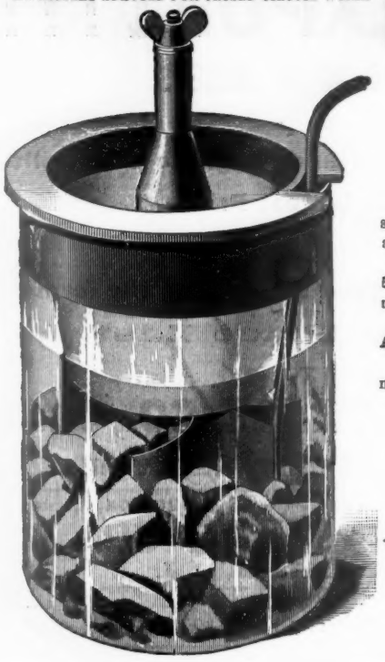

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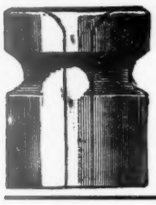

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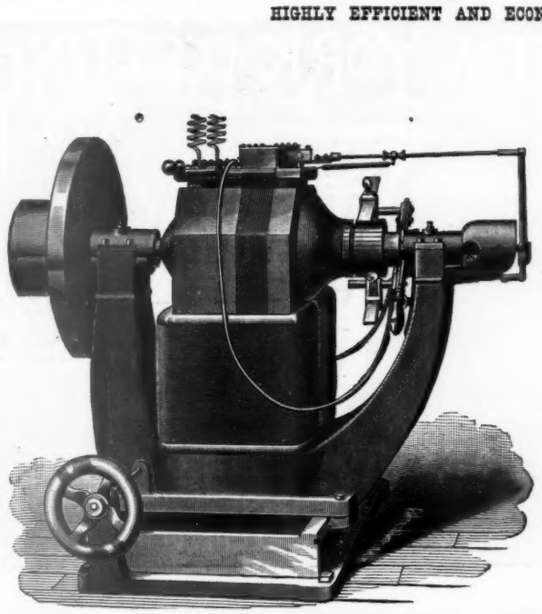

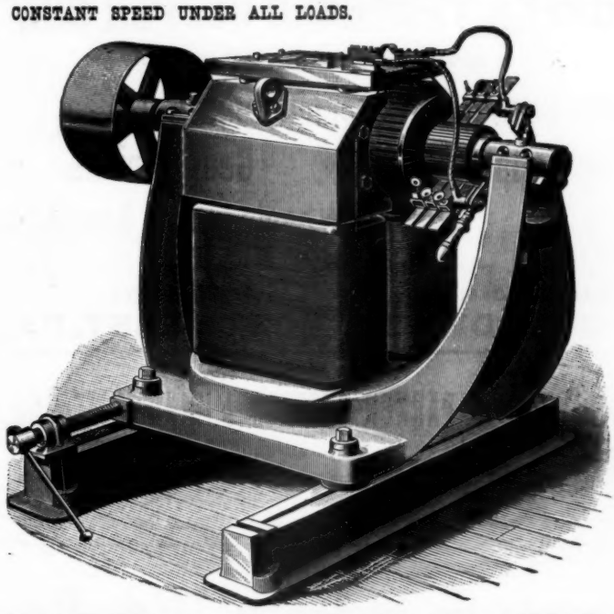

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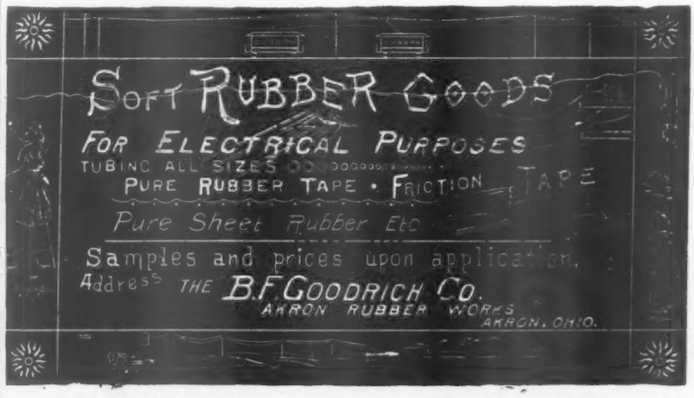

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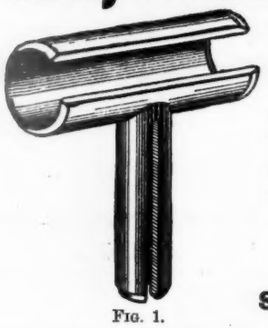

FIG. 1.

Fig. 1 represents Copper Tee used for branching from main cables, as shown in Fig. 2.

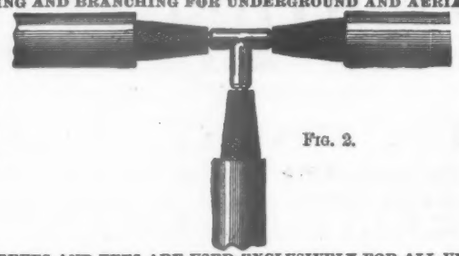

FIG. 2.

Fig. 3 represents a Copper Sleeve used for straight connections for continuation of cables.

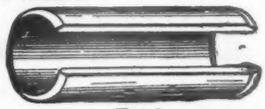

FIG. 3.

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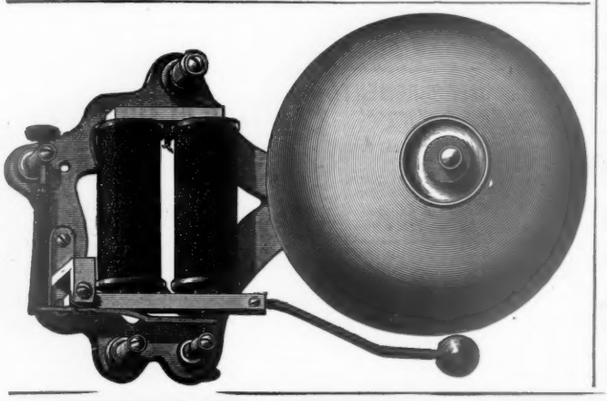

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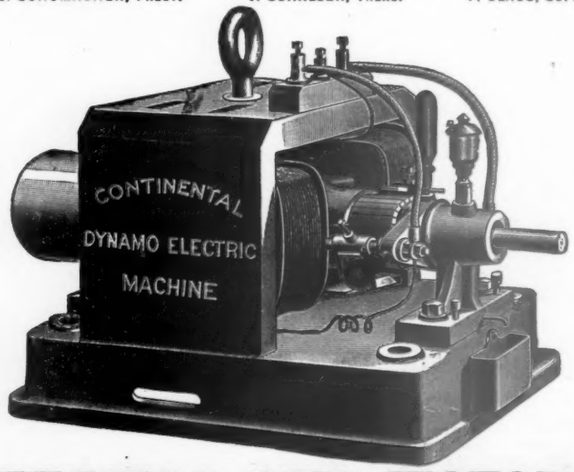

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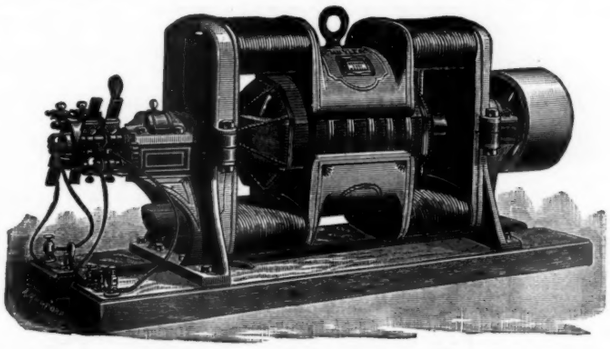

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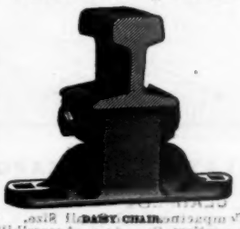

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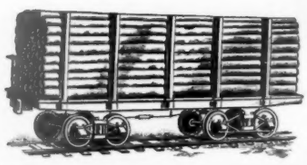

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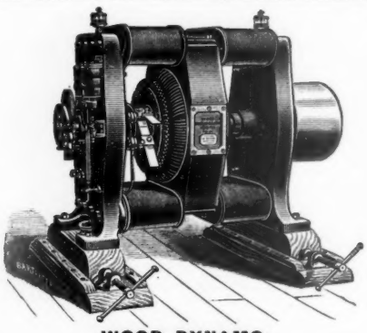

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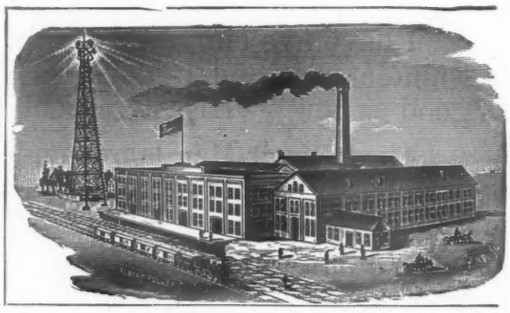

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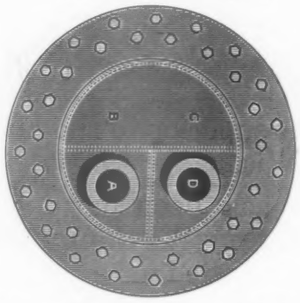

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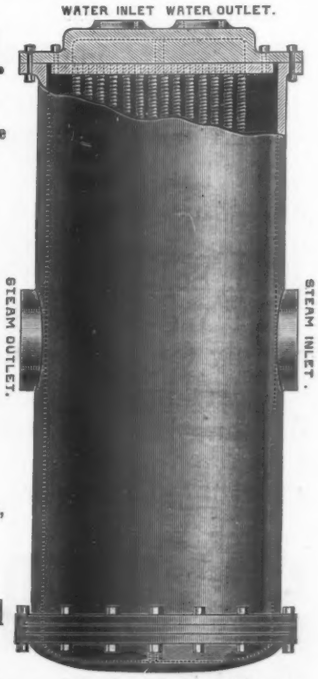

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